# WIRE
## & WIRE PRODUCTS

## Morgan-Connor Wire Machines

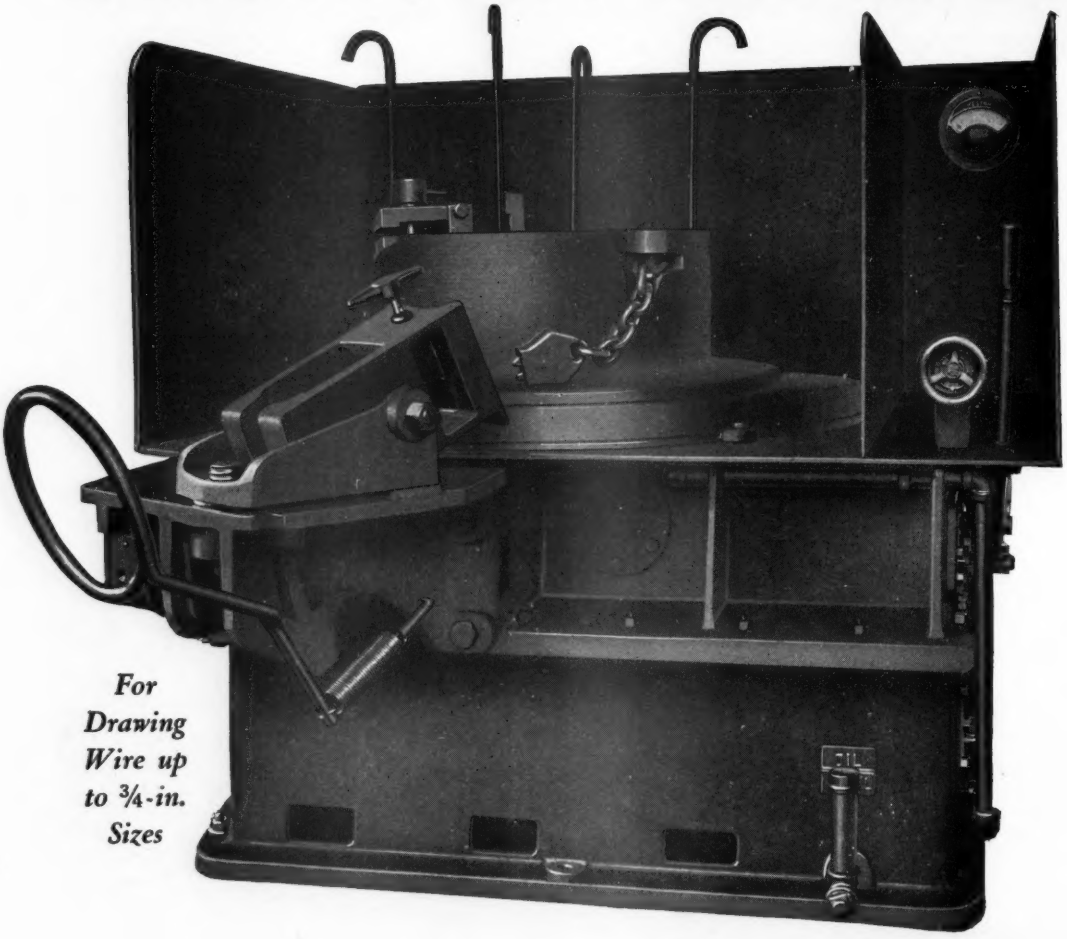
**1064 Blocks in Service - - - 686 Repeat Orders**

***Morgan Construction Co., Worcester, Mass.***

# MORGAN
## WORCESTER

**ENGINEERS AND MANUFACTURERS**

# VAUGHN (LARGE SIZE) MOTOBLOCS



*For Drawing Wire up to ¾-in. Sizes*

WHETHER your production is altogether or only occasionally in these large sizes, the Motobloc presents real advantages worthy of your serious consideration.

Powerful and fast for drawing ¾-inch wire, it is equally efficient for drawing smaller sizes. This means that there are no idle periods.

It is this unique ability to run a large number of sizes that makes the Vaughn Motobloc a 100% producer.

Furthermore, the excellent mechanical construction employed in the Motobloc results in unusual smoothness, cleanliness and low maintenance costs.

Why not investigate its many advantages?

## VAUGHN MACHINERY COMPANY

**CUYAHOGA FALLS, OHIO**

**Export Office—420 Lexington Avenue, New York City**



WIRE & WIRE PRODUCTS. Vol. 4, No. VII. July, 1929. Publication office, 49 East Washington Ave., Washington, N. J. Executive office, 551 Fifth Avenue, New York, N. Y. Published by the Quinn-Brown Publishing Corp., Richard E. Brown, President; Frank Quinn, Secretary and Treasurer. Subscription price: U. S. and Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class mail at the Post Office at Washington, N. J., under the Acts of March, 1879, and copyright, 1929, by Quinn-Brown Publishing Corporation.

# Wilhelm Breitenbach

## Machine Works and Foundry

**OF UNNA, WESTFALIA, GERMANY**

**FOUNDED: 1863** **FOUNDED: 1863**

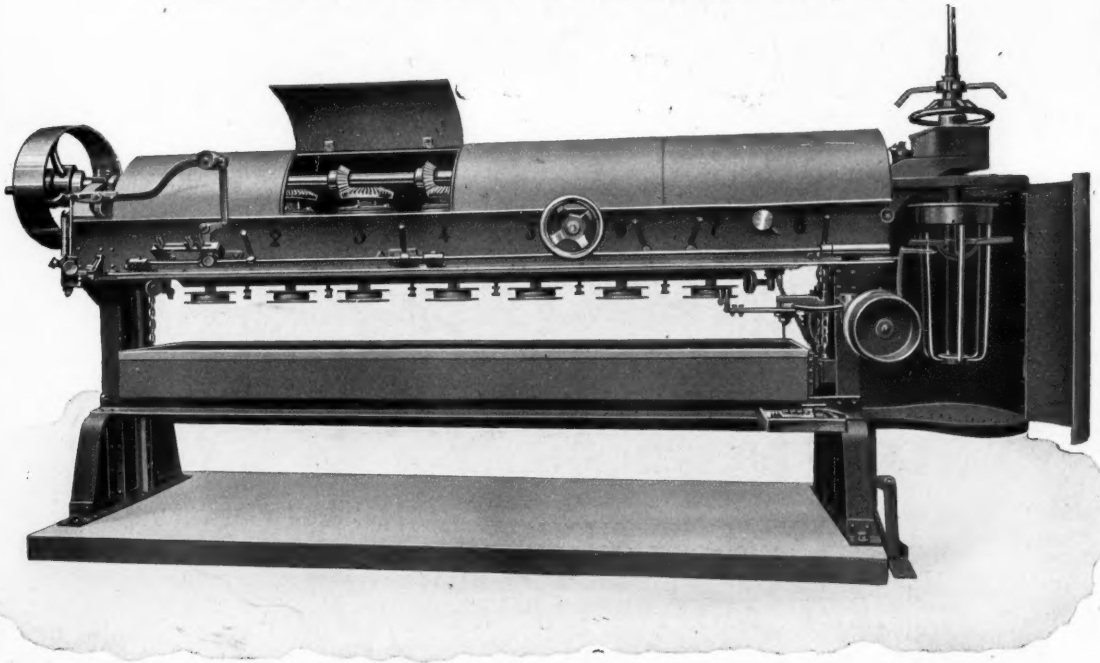
### SPECIALISTS IN WIRE FORMING MACHINERY

**I—PATENTED FRICTION DRAWING BENCHES** of standard and special construction for light and heavy draft. Outstanding features are: spiral spring friction clutch of special design; patented spindle-gear on ball-bearings, all enclosed in oil filled casing.

**II—BENCHES FOR THE DRAWING OF LIGHT AND CARD WIRE** of standard and special construction.

Of Exceptional Interest Are:

1—Light and Card Wire Benches with spiral spring friction clutch for special wire.
2—Light and Card Wire Benches with instantaneous disengaging coupling.
3—Card Wire Benches with built in spooling apparatus for Rope Wire.



**III—PATENTED MULTIPLE DRAWING BENCHES** for Iron Wire of from 3.5 mm. dia. Drawing drums and drawing stones fully submerged in cooling drawing liquid while machine is in operation. The output of 1000 kilogr. of from 0.8 to 2.2 mm. dia. iron-wire per man per day (eight hours) is unsurpassed.

**IV—SPOOLING APPARATUS** equipped with individual driving gears for the Annealing and zincing of Steel Wire. All dimensions.

**V—SPEED WINDLES** for the respooling of zinced wire. Apparatus for Wire Washing, Spraying, etc., etc.

*Sole Representative For The United States and Canada*

# J. I. BERNITZ

**25 Beaver St.**
**NEW YORK, U. S. A.**

**437 St. James St.**
**MONTREAL, CANADA**

## STRAIGHTENER SPECIALISTS
*SINCE 1866*

# Automatic Wire Straightening and Cutting Machinery

*MAKES THE WIRE PERFECTLY STRAIGHT*
*AND CUTS ABSOLUTELY ACCURATE LENGTHS*

WE ALSO MAKE MACHINERY FOR
FLAT WIRE---All kinds and many sizes
COLD DRAWN SHAPES---
Squares, Hexagons, Flats
STRIP METALS---All kinds, many sizes
SHEET METAL---All kinds, many sizes

## THE F. B. SHUSTER COMPANY
NEW HAVEN, CONN.
Formerly John Adt & Son Established 1866

ONE of our correspondents and well wishers who is an enthusiast about springs and spring design writes as follows from the Pacific coast:

* * *

"Out here I have seen springs used in places that have occurred to me but where I never really expected to see them used. They line ships' piers with big fellows in Frisco and Honolulu to take the pressure of a ship off the rigid concrete wharf, and I saw one ship's headline with a spring coupled near the loop. This takes the tugging strain off the hawser. It was not a good job, could have been much better design and proportion, but it is a clever idea nevertheless."

"Watching tugs tow freighters into Buffalo harbor last summer the same idea occurred to me, but evidently someone else is also thinking along these lines. More power to him—or them!"

* * *

The number of those who are thinking about springs from one point of view or another is considerable and includes ourselves. Springs are so important a wire product that anything new or significant about their design, construction or use is sure to find an alert and appreciative reading audience.

* * *

To quote from the manuscript of a contribution on spring design that will soon appear in these pages, "To the average man a spring is nothing but a coil of wire, and it is not much more than fifty years ago that this was nearly true of those who knew most about them."

* * *

Technical literature on the subject is still meagre and scattered. However, we expect to make some noteworthy additions to it in the course of the next few months in the form of contributions from competent men who report their own experiences with spring manufacture.

*The Publishers*


# WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 4 July, 1929 No. 7


## Contents


**New Tests Proposed for High Temperature and Electrical Resistance Alloy Wires** - - - - - - - 223
Standardized label colors and spool sizes also agreed upon in A. S. T. M. committee report.

**Wire Products in Aircraft Industry,** By John F. Hardecker - 225
Rivets, nails, springs, cotter pins and miscellaneous wire items used in abundance are rapidly becoming standardized.

**The Magnetic Analysis of Wire,** By John S. Hoffhine - 228
New simplified method makes possible rapid non-destructive tests of defects on a production basis.

**The Selection and Application of Wire Rope Lubricant** By C. D. Meals - - - - - - - 230
Recommendations for materials and methods to retard corrosion, reduce friction and insure longer life in service.

**News of the Industry** - - - - - - - - 232
Foreign trade opportunities. Industrial and trade developments. Personal mention. Building and expansion.

**X-Ray Investigation of Wire** - - - - - 236
Experiments with studies of crystallization in low carbon specimens promise possibilities of wider application for test purposes.

**A Digest of Recent Trade Literature** - - - - 237

**A Review of Recent Patents** - - - - - 238

**Paper Test for Defective Coatings** - - - - - 239

**How to Make a Ball Bearing Hand Truck** - - - 241

**New Products and Equipment** - - - - - 244

**Buyers' Guide** - - - - - - - - - - 249



**Editor**
**Frank Quinn**

**Associate Editors**
L. D. Granger George A. Paff

**Contributing Editor**
**M. A. Hall**

**R. E. Brown, Business Manager**

**Executive and Editorial Offices:**
**551 Fifth Avenue, New York City. Telephone: Murray Hill 10191**

**Publication Office: Washington, N. J.**

Issued Monthly
50 Cents a Copy

Annual Subscription, U. S., and Canada $5.00
Foreign, $7.50


Copyright, 1929

# UN-WIDIA ALLOY DIES

## A PROVEN PRODUCT

**Specialization makes for progress**
**We make dies exclusively**

Un-Widia Alloy Dies are the result of the collaboration of the world's best known makers of special alloys, Fried Krupp Co., and America's largest wire and tube die manufacturers, the Union Wire Die Corporation, who have the exclusive right to sell Widia metal, for drawing purposes only, in the United States, Canada, Mexico and France.

### Reduced Rejection Percentages

Un-Widia dies reduce to a negligible minimum rejections in mill, and by customer, for over size, out of round scratched, and poorly finished wire, and at the same time decrease materially the die cost and labor cost per ton of material drawn.

Reductions in rejection percentages of over 80% are not unusual experiences with mills previously using chilled iron, and steel dies, and now using Un-Widia Alloy dies.

**THE KRUPP PRODUCT**
**Widia metal is made into dies**
**and sold exclusively in the**
**UNITED STATES, CANADA and FRANCE**
**BY**

# UNION WIRE DIE CORPORATION

**NEW YORK**

WIRE & WIRE PRODUCTS

Vol. 4 JULY, 1929 No. 7

# New Tests Proposed for High Temperature and Electrical Resistance Alloy Wires

## Standardized label colors and spool sizes also agreed upon in A. S. T. M. committee report

ONE of the reports presented at the thirty-second annual meeting of the American Society for Testing Materials, held at Atlantic City June 24 to 28, was that of Committee B-4 on High Temperature and Electrical Resistance Alloys, from which the excerpts that follow were selected.

A test to determine the durability of electrical heating wires at operating temperatures was recommended for publication as a tentative standard and a description of the technique is now available in printed form. The method covers the determination of the resistance to oxidation at high temperatures under intermittent heating of metallic materials for electrical heating and is applicable to two general classes of materials: Class A, alloys suitable for commercial service up to 1100 degrees C. (2012 degrees F.) and Class B, alloys suitable for commercial service up to 900 degrees C. (1652 degrees F.).

The specimen having nominal diameter from Nos. 20 to 22 A. w. g. is intermittently heated by electric current with a cycle of two minutes on and two minutes off, under constant voltage conditions. The intermittent test corresponds to intermittent service of various household electrical heating appliances. The temperature of the specimen is measured by an improved form of optical pyrometer. The life obtained with the intermittent test is much shorter than with continuous heating at the same temperature.

### Method of Test

The specimen is mounted vertically, dipping into a mercury cup at the bottom to provide for expansion and is kept straight by a small weight suspended from it. Vertical and horizontal catenary mounting were compared and the vertical mounting was found to be more convenient and also avoided the temperature variations obtained when horizontal specimens were mounted above each other.

In order to obtain consistent results it has been found necessary to closely control the voltage and the initial temperature of the specimen and also to shield the specimen from draughts of air.

Tests were made with the current cycle off-and-on periods varying from ten minutes on and five minutes off to 30 seconds on and 30 seconds off, and it was found that the cycle of two minutes on and two minutes off gave the shortest life for a given temperature. It appears that the time for cooling has to be sufficient to permit the specimen to reach a low enough temperature to cause any loosening or cracking of scale which will occur due to variations in coefficient of expansion of the scale and the metal.

Life tests were made on a typical Class A alloy of 80 per cent nickel and 20 per cent chromium and on a typical Class B alloy of 60 per cent nickel, 15 per cent chromium and 25 per cent iron in three different laboratories in accordance with the proposed methods. The results obtained were as follows:

CLASS A ALLOY

| | Number of Tests |
|---|---|
| Laboratory A | 4 |
| Laboratory B | 4 |
| Laboratory C | 8 |

| Average Hours of Life | Average Deviation Per Cent |
|---|---|
| A 115.5 | ±7.0 |
| B 106.4 | ±3.8 |
| C 118.7 | ±8.0 |
| Av. 114.8 | |

CLASS B ALLOY

| | |
|---|---|
| Laboratory A | 4 |
| Laboratory B | 4 |
| Laboratory C | 4 |

| Average Hours of Life | Average Deviation Per Cent |
|---|---|
| A 112 | ±1.8 |
| B 110 | ±7.8 |
| C 114 | ±1.3 |
| Av. 112.3 | |

## Chemical Analysis

It was recommended that tentative methods of chemical analysis of metallic materials for electrical heating be revised by the addition of procedures (described in detail in the report) for determinations of copper in nickel copper alloys containing from 10 to 90 per cent of copper and in alloys of chromium with iron or nickel or both containing copper up to 5 per cent. The proposed methods have been tried in three laboratories with the following results:

| Laboratory | Nickel-Copper Alloy Copper, P. C. | Nickel-Chromium Alloy, (80 Nickel 20 Chromium), Copper, P. C. |
|---|---|---|
| No. 1 | 53.50a | 0.143b |
| No. 2 | 53.46b | 0.155b |
| No. 3 | 53.42c | 0.139c |
| Lowest Individ'l result | 53.42 | 0.130 |
| Higest Indvid'l result | 53.51 | 0.156 |
| Av. result of all determinations | 53.46 | 0.146 |

a Average of four determinations.
b Average of three determinations.
c Result of a single determination.

The committee has made arrangements to carry on this work. Experimental work has been under way for six months to develop a method of test for the elastic properties of alloys at temperatures from 500 to 1000° C. The work has not yet been completed but promising results have been obtained.

## Density and Electrical Resistivity

At the request of the committee tests were made by the U. S. Bureau of Standards to determine the effect of the size of wire or ribbon upon the density and electrical resistivity, all sizes of each grade of alloy being made from the same lot of material. The results secured, given in the accompanying Tables I and II, indicate that density and resistivity do not vary with size.

The Chromel samples were all heated together and slowly cooled, while the Nichrome samples were supplied as normally produced. Since the normal process is a quench from varying temperatures, depending upon the size, the variations in resistivity between the samples of Nichrome and between the Nichrome and the Chromel were of the magnitude of the variation in the data on the effect of quenching, previously submitted to the committee.

Table 1. Results of Tests on Resistivity of Nichrome and Chromel Wires.

| Designation | Approximate Length of Test Specimen, m. | | | | Resistivity at 25° C., michrohm-centimeters | | | |
|---|---|---|---|---|---|---|---|---|
| | Nichrome IV | Nich rome | Chro mel A | Chromel C | Nichrome IV | Nich rome | Chro mel A | Cromel C |
| 1-32 by 0.005 in. | 4.2 | 3.8 | 5.0 | 4.8 | 104.65 | 109.55 | 108.5 | 113.0 |
| 1-16 by 0.005 in. | 3.3 | 3.8 | 5.0 | 5.0 | 105.15 | 109.65 | 108.35 | 113.0 |
| ⅛ by 0.005 in.. | 3.9 | 3.9 | 4.9 | 4.9 | 105.35 | 109.6 | 108.1 | 112.75 |
| ⅛ by 0.010 in.. | 4.0 | 4.4 | 4.0 | 4.7 | 104.8 | 109.75 | 108.0 | 112.8 |
| ⅛ by 0.032 in.. | 3.7 | 3.5 | 2.8 | 2.8 | 106.0 | 109.7 | 108.1 | 112.7 |
| ⅛ in. ..... | 0.9 | 0.9 | 0.9 | 0.9 | 102.65 | 108.9 | 108.45 | 113.3 |
| ¼ in. ..... | 0.9 | 0.9 | 0.9 | 0.9 | 104.5 | 109.65 | 108.4 | 112.9 |
| No. 22 ..... | 4.7 | 4.4 | 4.9 | 5.0 | 103.8 | 109.85 | 108.25 | 112.15 |
| No. 30 ..... | 4.4 | 4.6 | 5.0 | 5.0 | 103.35 | 110.1 | 108.55 | 111.9 |

Table II.—Results of Tests on Density of Nichrome and Chromel Wire.
Density at 20° C., G. per cu. cm.

| Diameter of Wire | Nichrome IV | Nichrome | Chromel A | Chromel C |
|---|---|---|---|---|
| ⅛ by 0.032 in | 8.345 | 8.197 | 8.402 | 8.233 |
| ⅛ by 0.010 in | 8.372 | 8.218 | 8.407 | 8.231 |
| ⅛ by 0.005 in. | 8.344 | 8.187 | 8.403 | 8.233 |
| 1-16 by 0.005 in. | 8.346 | 8.176 | 8.387 | 8.226 |
| 1-32 by 0.005 in. | 8.328 | 8.184 | 8.396 | 8.227 |
| ⅛ in | 8.377 | 8.209 | 8.403 | 8.220 |
| ¼ in. | 8.376 | 8.214 | 8.408 | 8.226 |
| No. 30 | 8.362 | 8.198 | 8.405 | 8.230 |
| No. 22 | 8.353 | 8.145 | 8.394 | 8.223 |

Note—Check obeservations gave in practically all cases values consistant to ±0.002 g. per cu. cm. in density.

## Temper

A method of test has been outlined for testing wire and ribbon to determine the uniformity of stretch when wound into helical coils. A test coil is wound under uniform conditions, and is stretched until it has acquired a permanent set. The variation in the pitch of the helix indicates the uniformity of the wire. This method is being tried in several laboratories.

## Label Colors

Several manufacturers indicate the grade of electrical heating and electrical resistance wires by the color of the label on the spool of wire, but different colors for the same grade of wire are used by different manufacturers.

The standardization of colors has been taken up with various wire manufacturers and the following list of colors has been agreed upon.

80 per cent nickel, 20 per cent chromium ..... yellow
85 per cent nickel, 15 per cent chromium ..... white
Nickel-chromium-iron ..... red
55 per cent copper, 45 per cent nickel ..... pink
70 per cent copper, 30 per cent nickel ..... blue
Nickel steel, low chromium ..... lavender
Pure nickel ..... green
Manganese nickel ..... salmon pink
Monel metal ..... orange

These color requirements will be incorporated in specifications for the materials when such specifications are prepared. The list of colors is being forwarded to the Division of Simplified Practice of the Department of Commerce for its information.

## Spool Sizes

The dimensions of spools used for electrical heating and electrical resistance wires by the various manufacturers were nearly the same, but different in some respects. Standard sizes of spools were desirable both from the standpoint of manufacturers and users of wire.

The following dimensions of spools have been agreed upon by the committee and will be incorporated in specifications for wire when such specifications are prepared:

| Weight of Wire, LB. | Spool Dimensions: Diameter of Flange, In. | Traverse, In. | Diameter of Hole, In. | Diameter of Barrel, In. |
|---|---|---|---|---|
| 1 | 2 | 3 | ⅝ | 1¼ |
| 2 | 2¾ | 3 | ⅝ | 1½ |
| 5 | 4 | 3 | ⅝ | 1½ |
| 10 | 6 | 3 | ⅝ | 1¾ |

The list of spool sizes is being forwarded to the Division of Simplified Practice of the Department of Commerce for its information.

# Wire Products in Aircraft Industry

## Rivets, nails, springs, cotter pins and miscellaneous wire items used in abundance are rapidly becoming standardized

*By John F. Hardecker*

*Chief Draftsman, United States Navy Yard*
*Naval Aircraft Factory, Philadelphia*

THE composite picture of the amazing development of the airplane has been unfolding so rapidly, that the intimate details have often been lost sight of while all attention has been forcused on the main picture—the airplane itself. The wire industry has played a major role in this development, and to examine at first hand but one phase of its contribution, namely, wire products, is the primary purpose of this article. It is not through mere volume or diversity that they stand out, for they perform some significant and essential functions in aircraft fabrication.

### Rivets

One of the most significant developments in modern airplane construction has been the trend toward all-metal planes. The most commonly used material for this purpose is the light aluminum alloy commonly called duralumin, which has the strength of mild carbon steel at one third the weight. Fabrication is entirely by riveting, and in order to obviate any difficulties such as corrosion by electrolytic action, the rivets should be of the same composition as the metals joined together. In non structural parts where high strength is not required, such as cowling, tanks, etc., aluminum is generally used in lieu of the harder and more costly duralumin. The significance and volume of this type of riveting cannot be too strongly emphasized, as it applies to practically all parts of the structure of the entire airplane—fuselage, hull, wings, tail, engine mounting, floats, etc.

Duralumin rivets are made from either drawn or extruded wire, at the option of the rivet manufacturer, since the aircraft manufacturer can see no particular advantage of the use of one type of wire over the other. The wire is used in the annealed condition. Its chemical composition is as follows:

**Duralumin Specifications**

| | |
|---|---|
| Copper | 3.5 to 4.5 percent |
| Magnesium | 0.2 to 0.75 percent |
| Manganese | 0.4 to 1.0 percent |
| Aluminum (Minimum) | 92 percent |

The tolerance on diameters of .051 inch to 0.64 inch is minus .002 inch, and on diameters over .064 inch to .375 inch it is minus .004 inch.

The tensile strength of annealed duralumin wire for rivets is as follows:

Tensile Strength (Maximum) 35000 lbs. per sq. in.

Elongation (Minimum) 12 percent.

Annealed duralumin rivet when heat treated and aged must conform to the following physical properties:

Tensile Strength (Minimum) 55,000 lbs. per sq. in.

Yield Point (Minimum) 25,000 lbs. per sq. in.

Elongation (Minimum) 18 percent.

Specimens of duralumin wire less than .125 diameter must withstand bending cold through an angle of 180 degrees around a diameter equal to the diameter of the wire, and those from .125 to .375 diameter must stand the bend around a diameter equal to four times the diameter of the wire.

Aluminum rivets are made from aluminum wire in the half hard condition. This wire must contain not less than 99% aluminum. The tensile strength required is 22000 lbs per sq. in., and a minimum elongation of 5%, in the half hard condition. The material shall stand cold bending through an angle of 180 degrees on a radius equal to the diameter of the wire.

In order to obtain the maximum strength of duralumin rivets, they are heat treated just prior to use and driven before they become hardened through ageing. Those not driven within a certain period of time after heat treatment, are returned to the furnace for retreatment. Aluminum rivets are driven as is without heat treatment.

### Special Marking of Heads

Since the forms of the heads used on both duralumin and aluminum rivets are the same, and there is grave danger in confusing the two due to the similarity in appearance of the metals, a condition which would be dangerous due to the far lower strength of the aluminum rivets, it has been necessary to adopt some standardized means of positive identification. The Army-Navy Standard for these rivets specifies that all duralumin rivets shall have a raised tit on their head for identification. While this marking will be obliterated, at least in part, by the driving operation, the chief interest in their identification is prior to driving, so that this mark well serves its purpose.

While there are many interesting variations in duralumin and aluminum rivet heads for

special purposes, the essential types are the round head, flat head and countersunk head types. Army and Navy Standards, commonly called AN Standards, have been adopted for the round head and flat head types. Tolerances are relatively very close on all dimensions, due to the exactitude of aircraft work, and in the smaller lengths, the increment of length is as low as 1/16 of an inch.

### Countersink Presents Difficulties

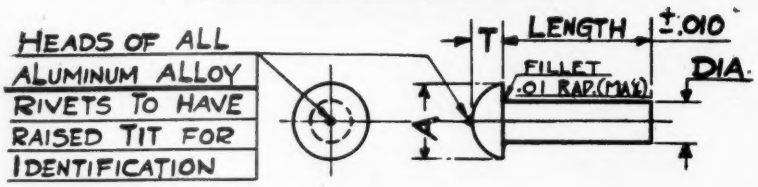
The countersunk head duralumin and aluminum rivet is in process of development, and no universally accepted standard has as yet been developed. Existing commercial standards present too sharp an angle of countersink for the extremely thin gauges of metal commonly used in aircraft fabrication. The present trend is toward an accurately designed rivet head, probably varying for the various diameters in proportions in order to develop the maximum strength of joint. The included angle of countersink will probably exceed 120°, with a tendency to use a conical countersunk head for the smaller sizes in thin gauge material countersunk by dimpling by means of a punch, and an oval countersunk head for the heavier gauges which will be countersunk by machining.

### Mechanical Riveting Problem

An interesting variation in the use of duralumin rivets is encountered in the Metal Clad Airship now reaching completion by the Aircraft Development Corporation at Detroit, Mich. The skin of this airship is .008 inch duralumin, and required about 3,000,000 very small duralumin rivets for riveting the seams. One of the serious problems encountered was to devise methods for doing the riveting mechanically. The seams have a width of ½ inch, and are joined with three rows of rivets, 12 per inch in each row. A special automatic riveting machine has been developed which makes the rivets from duralumin wire .039 inches in diameter. This automatically feeds the wire into the machine, makes the rivets, feeds the work and puts the rivets into place at a rate of over 5000 rivets per hour. This machine in a way operates considerably like a sewing machine, and the strength of the seam produced exceeds the yield point of the sheet itself.

Commercial tinned copper and iron rivets are used in flat, round and countersunk heads for tank construction work on copper, brass and terneplate tanks. These rivets, however, are generally specified by ounces and pounds, which gives but one length for a given diameter, and hence too large a diameter for the longer lengths for aircraft use, but rather by diameter with increments of length varying by ⅛ inch. Commercial steel rivets are used in the same head types for structural steel fabrication, although it must be noted that the prevailing practice in steel joining is by welding.

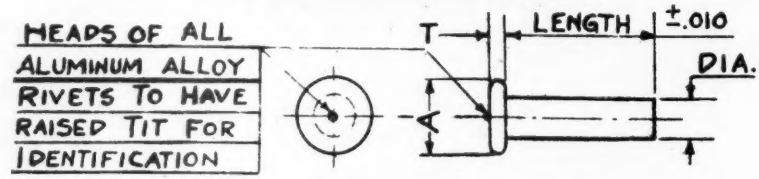
### Army-Navy Standard For Round Head Rivet (Duralumin and Aluminum)




—DIMENSIONS.—

| DIA. | 1/16 +.003 -.001 | 3/32 +.003 -.001 | 1/8 +.0035 -.001 | 5/32 +.004 -.001 | 3/16 +.004 -.001 | 1/4 +.004 -.001 | 5/16 +.004 -.001 | 3/8 +.004 -.001 |
|---|---|---|---|---|---|---|---|---|
| A | 1/8 ±.006 | 3/16 ±.009 | 1/4 ±.012 | 5/16 ±.016 | 3/8 ±.019 | 1/2 ±.025 | 5/8 ±.031 | 3/4 ±.037 |
| T | .047 ±.005 | .070 ±.005 | .094 ±.005 | .117 ±.005 | .141 ±.007 | .188 ±.009 | .234 ±.012 | .281 ±.014 |

### Army-Navy Standard For Flat Head Rivet (Duralumin and Aluminum)




—DIMENSIONS.—

| DIA. | 1/16 +.003 -.001 | 3/32 +.003 -.001 | 1/8 +.0035 -.001 | 5/32 +.004 -.001 | 3/16 +.004 -.001 | 1/4 +.004 -.001 | 5/16 +.004 -.001 | 3/8 +.004 -.001 |
|---|---|---|---|---|---|---|---|---|
| A | 1/8 ±.006 | 3/16 ±.009 | 1/4 ±.012 | 5/16 ±.016 | 3/8 ±.019 | 1/2 ±.025 | 5/8 ±.031 | 3/4 ±.037 |
| T | .025 ±.005 | .038 ±.005 | .050 ±.005 | .062 ±.005 | .075 ±.005 | .100 ±.005 | .125 ±.005 | .150 ±.007 |

### Purlin Nails for Wood

The thin head plain copper rivet, commonly called a purlin nail, when used with copper burrs and riveted over, is an important factor in the fabrication of main structural members of wood floats, hulls, fuselages and box beams in wings. The commercial purlin nail is used, but it is important that when burrs are selected to go with a given diameter of purlin nail, that they fit tightly on the diameter. This is necessary so that they drive on and pull up in the wood members to be joined and hold them rigidly together during riveting. Loose fits lead to unsatisfactory workmanship, and it is important that the rivet supplier check this fit before shipment, and not depend too much upon mere similar purlin nail and burr numbers. Purlin nails have been made of duralumin, but are not in general use.

Double duckbill rivets of duralumin have been used for fast-

ening together the various layers of planking for hull and float bottoms, but this is not the prevailing practice. An interesting recent development has been the design and construction of seaplane floats using monel metal. While the monel metal is very heavy, it resists salt water corrosion without protective coating, while the duralumin float though lighter still is very seriously affected by corrosion despite the protective treatments evolved for it. The monel metal float is assembled by the use of monel metal rivets of the usual types.

### Nails

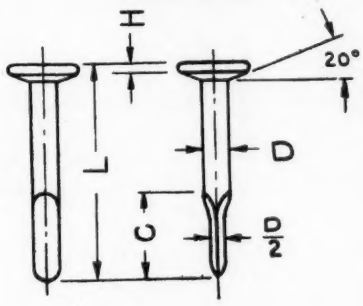
Cement coated flat head brass nails are used for ribs, beams, gussets, corner blocks and in fact for all wood construction where parts are glued together. These nails are sometimes barbed in addition, but the plain cement coated are more generally used. Similar nails are also used in steel, the prevailing diameters for both materials being No. 20, No. 18, No. 16 and No. 14 U. S. steel wire gauge, with lengths varying from 3/8 to 1¼ inches.

The brass clinch nail or beaver tail nail is used a great deal in planking for the bottom, sides and decks of wood floats and hulls, fuselage and wing beams. It is a special nail and must conform rigidly to the dimensions set for it, otherwise it will not bend over properly, with a consequent loss of holding power and splitting of the planking.

### Uses of Commercial Nails

Flat head wire nails have at times been used when made of copper and duralumin, but they never attained to any general usage. Commercial upholstery nails are used for upholstering of chairs, cabin interiors, head rests, cockpit openings, etc. Commercial steel wire nails and brads are used by the aircraft industry in considerable quantites for packing, forms, jigs, patterns, etc., but seldom in the plane itself. Commercial brass escutcheon pins are used as a trim nail, and for fastening copper binding strips in wood construction. Duralumin escutcheon pins have been made, but they are seldom used.

## Brass Clinch Nail Dimensions




| D B.W.G. | L | C | H |
|---|---|---|---|
| No. 18 (.049) | 1/4 | 3/16 | .010 |
| No. 18 (.049) | 5/16 | 3/16 | .010 |
| No. 18 (.049) | 3/8 | 3/16 | .010 |
| No. 17 (.058) | 7/16 | 1/4 | .012 |
| No. 17 (.058) | 1/2 | 1/4 | .012 |
| No. 16 (.065) | 3/8 | 1/4 | .013 |
| No. 16 (.065) | 7/16 | 1/4 | .013 |
| No. 16 (.065) | 1/2 | 1/4 | .013 |
| No. 16 (.065) | 9/16 | 1/4 | .013 |
| No. 16 (.065) | 5/8 | 9/32 | .013 |
| No. 16 (.065) | 3/4 | 9/32 | .013 |
| No. 16 (.065) | 7/8 | 9/32 | .013 |

| D B.W.G. | L | C | H |
|---|---|---|---|
| No. 16 (.065) | 1 | 9/32 | .013 |
| No. 16 (.065) | 1 1/8 | 9/32 | .013 |
| No. 14 (.083) | 1 1/4 | 9/32 | .016 |
| No. 14 (.083) | 1 3/8 | 9/32 | .016 |
| No. 14 (.083) | 1 1/2 | 9/32 | .016 |
| No. 14 (.083) | 1 5/8 | 9/32 | .016 |
| No. 14 (.083) | 1 3/4 | 9/32 | .016 |
| No. 14 (.083) | 1 7/8 | 9/32 | .010 |
| No. 14 (.083) | 2 | 9/32 | .016 |
| No. 14 (.083) | 2 1/4 | 9/32 | .016 |
| No. 14 (.083) | 2 1/2 | 9/32 | .016 |

### Springs

Commercial steel spring music wire is used for all springs in structural parts, and for many engine uses. In engines it is used for inlet and exhaust valve springs, fuel and oil pressure relief valve springs, magneto coupling springs, oil strainer springs, generator clutch springs, fuel pump by-pass springs, tachometer drive shaft springs, push rod tube springs and many other uses.

Phosphor Bronze spring wire also is used to a considerable degree, particularly where corrosion exposive is encountered. The chemical requirements are generally as indicated in the accompanying table.

Spring design in aircraft work is very exacting, so that it is essential that only the very best spring wire of uniform high quality be used. The unexpected failure of a spring at times may prove fatal to the pilot and plane.

### Miscellaneous

Commercial cotter pins, both steel and brass, find a considerable usage in aircraft structural and engine parts, as all bolts, pins, etc., must be positively fastened and at the same time be easily removable for overhaul and repair. Commercial brass wire mesh is used for fuel and oil strainers. Commercial phosphor bronze cable is used for trailing edges on wing and tail surfaces, and also for controls where steel cable would interfere with the operation of compasses. Duralumin wire has also been used for trailing edges. Commercial soft galvanized iron wrapping wire is used for serving non-flexible cable splices, and soft commercial copper wire for safety wiring of turnbuckles and fairleads. Commercial brass wire cup hooks, figure eight hooks, etc., are used for a multiplicity of general purposes.

(*Please turn to page 246*)

## Chemical Analysis—Phosphor Bronze Spring Material

| Copper (min) Per cent | Tin (min) Per cent | Zinc (max) Trace | Iron (max) Per cent | Lead (max) Per cent | Phos. Per cent |
|---|---|---|---|---|---|
| 94 | 3.50 | | 0.10 | 0.20 | 0.05-0.50 |

The physical properties usually required are as follows:

| Diameter or thickness of material | Tensile strength per square inch (minimum) Pounds | Elongation in 2 inches (minimum) Per cent |
|---|---|---|
| Up to and including 0.025 inch | 150,000 | |
| Above 0.025 and including 0.0625 inch | 135,000 | 1.5 |
| Above 0.0625 and including 0.125 inch | 130,000 | 2.0 |
| Above 0.125 and including 0.250 inch | 125,000 | 3.5 |
| Above 0.250 and including 0.375 inch | 120,000 | 5.0 |
| Above 0.375 and including 0.500 inch | 105,000 | 9.0 |

# The Magnetic Analysis of Wire

## New simplified method makes possible rapid non-destructive tests of defects on a production basis

*By John S. Hoffhine*

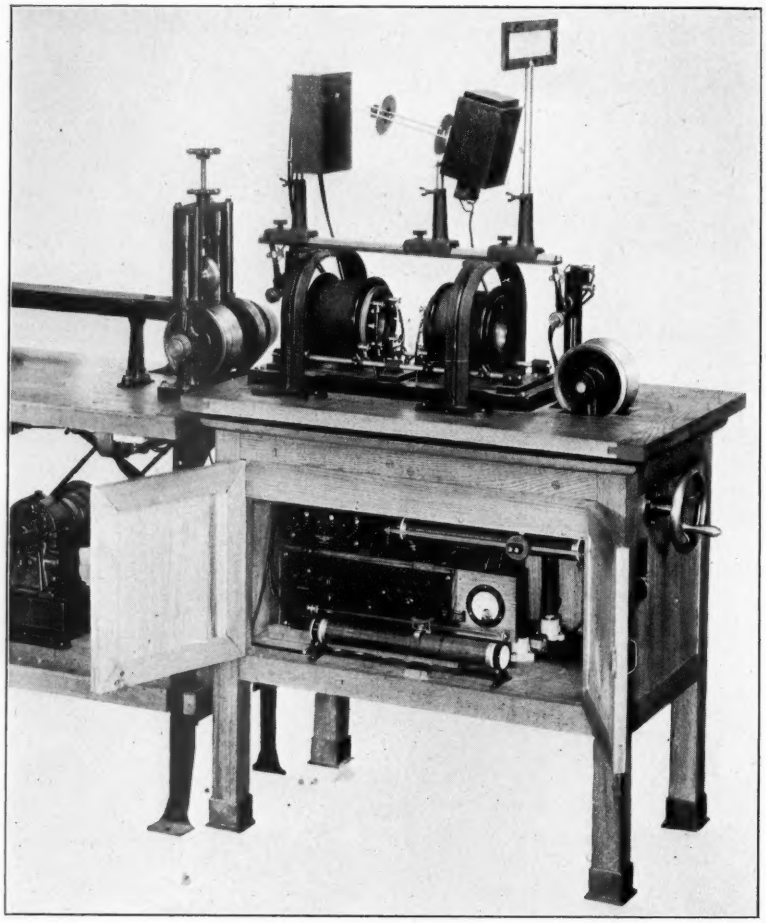
*President, Magnetic Analysis Corporation*

MAGNETIC Analysis accomplishes the following definite things:

It furnishes a means for matching or sorting iron and steel products as to quality and heat treatment more rapidly than any method heretofore used and with great accuracy. This feature of magnetic analysis may be applied semi-automatically and without the aid of technical experts.

It furnishes a means, the only one now available, for locating internal flaws and imperfections in iron and steel products, without destruction of the specimen under test. This makes it possible to put into actual use the parts that have been tested and certified instead of, as heretofore, testing one piece out of a dozen or a hundred, and gambling on the hope that the remainder are like this piece which has been destroyed in process of test. This new testing method may be applied on a production basis and without the service of experts, in some cases semi-automatically.

In doing these two things Magnetic Analysis is of service to the entire field of iron and steel products and greatly enhances the value of the products thus tested. Practically three-quarters of the steel products of the world need or could profitably be subjected to one or both of the tests here made available.



Magnetic wire testing production equipment with visual signal for recording defects. Filters make it possible to emphasize or minimize any particular qualities looked for.

### Based on Burrows Discovery

The science of Magnetic Analysis consists in the systematic correlation of the magnetic and other properties of materials and in the application of the laws and principles which underlie the interrelations of such properties, in particular the interrelations of the magnetic and mechanical properties of steel. It is based upon the fundamental observation made by Dr. Charles W. Burrows who was in charge of the magnetic section of the U. S. Bureau of Standards when he made his notable investigation of magnetic analysis of steel. He observed that "there is one, and only one, set of mechanical characteristics corresponding to a given set of magnetic characteristics, and conversely there is one, and only one, set of magnetic characteristics corresponding to a given set of mechanical characteristics."

The art of Magnetic Analysis consists in the measurement of the magnetic characteristics, or better, a small number of the magnetic characteristics of the specimen under test, and from this measurement determining its mechanical properties

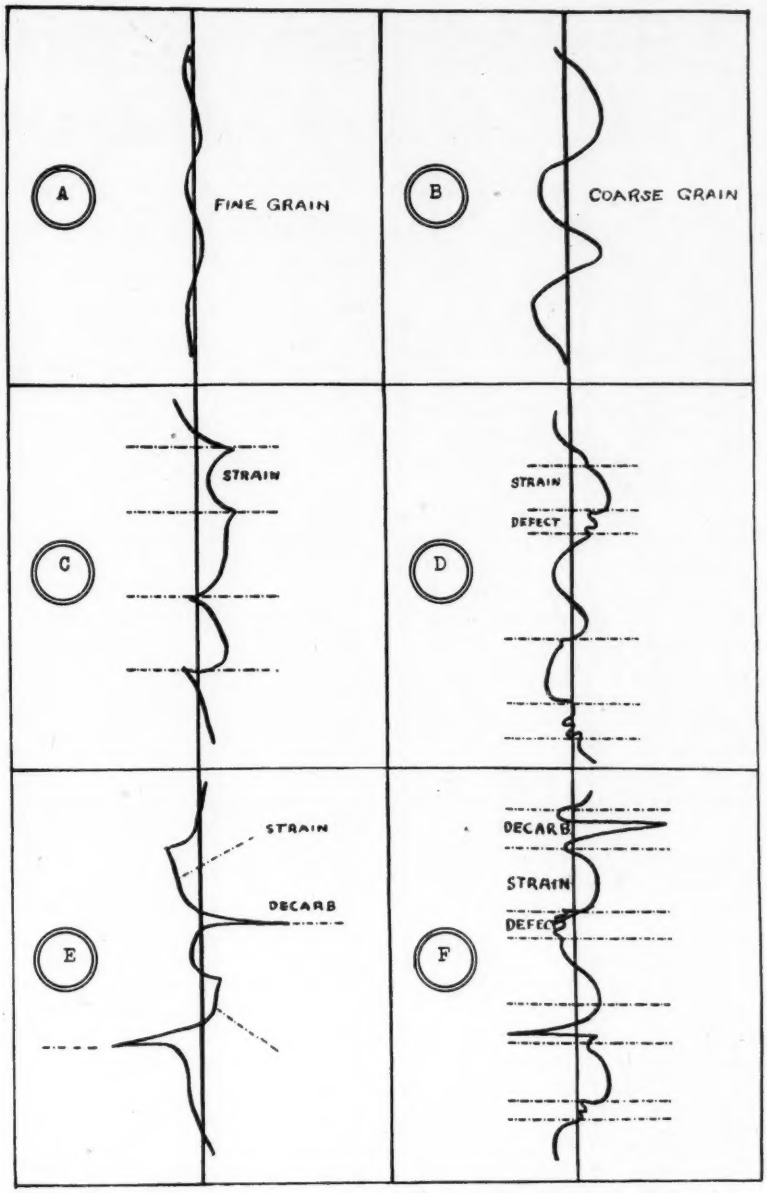
Up until now in the manufacturing process of making wire, the chemical composition has played an all-important part to-

gether with certain old established physical tests such as tensile and bending tests. All of these tests are of a destructive nature and this means that it has not been possible to establish certain known properties in a piece of wire such as uniformity, and be able to save one specimen as a standard and destroy the remainder to determine certain physical properties and know that both portions of the specimen were alike in their physical properties. Only a certain length or piece of wire is taken from a bundle by the old method of inspection and tested to destruction, and it is assumed that the test specimen is representative of the whole bundle.

### Advantage Over Old Methods

The magnetic testing of wire has proven this assumption to be false. The requirements of wire today in many of the arts is so high as compared to past periods that the old methods of testing such as tensile and bending tests have proven unreliable in solving the causes of failures in many cases. The magnetic analysis of wire is the most advanced, practical and accurate method of testing, as it is possible by this method to obtain variations within a single property, quantitively as well as qualitatively, and without destroying or affecting the specimen in any way. It can readily be seen by such a method that the whole previous history of the manufacture of the wire is revealed and therefore makes it possible to distinguish whether any physical properties of a serious nature have been introduced by incorrect practices of manufacture.

The accompanying cut shows a magnetic production testing equipment with a light signal relay recording means. Many other suitable recording means or indicating devices of a similar nature may be employed. By the means shown only one physical property is indicated at a time. These indications, however, are quantitive and it is possible in indicating a single property such as defects both external and internal, to eliminate small defects of an inconsequential nature and only show those that are large or important for the specific requirements to which the wire is to be put. Stating this in a different way, any physical property may be eliminated or emphasized and the recording or indicating instruments can be calibrated to show only physical properties of a magnitude out of the range of the specifications and not recording those within the range. This is accomplished by suitable filter instruments.




The following is an explanation of the oscillograms: A—Shows Normal Grain Size only. B—Shows Coarse Grain Size only. C-D—Shows internal Strain and Defects. E—Shows Surface Decarbonization and Strain. F—Shows Surface Decarbonization, Internal Strain and Defects.

By a single passage of a length or coil of wire through the magnetic testing equipment, the oscillograms shown in the accompanying cut, reveal simultaneously the various properties and the variations in the wire. The following is an explanation of the oscillograms:

Each wire of different chemical specifications has a fundamental wave form in an oscillogram which is always the same for that particular kind of wire. All additional physical properties occurring (strains, decarbonization, defects, in-

(*Please turn to page 245*)

# The Selection and Application of Wire Rope Lubricant

## Recommendations for materials and methods to retard corrosion, reduce friction and insure longer life in service

*By C. D. Meals*
*Chief Engineer, American Cable Company*

MOST users of wire rope are aware of the fact that, at the time the rope is fabricated, its core is impregnated with a chemically neutral lubricant. Unfortunately, however, it is not sufficiently appreciated that this initial lubrication of the core is not permanent; and that, if maximum life from a wire rope in service is to be obtained, the rope must be effectively lubricated at frequent intervals —this implying the use of a lubricant of the correct grade, properly applied.

In other words, though the "life" of a wire rope is influenced by such factors as method and materials of construction, manner of winding, intensity of the service, high temperatures, presence of water, acids or alkalies, the most important factor determining how long the rope will last is the degree to which it is protected by effective lubrication.

Some essential facts that you should know about the selection and application of lubricant to wire rope in order to obtain most effective lubrication will be discussed herein.

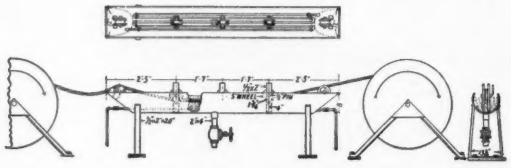
**Why Lubrication Is Necessary**

Wire rope cores are of two main types:

1. With a hemp center.
2. With a wire rope center.

In the majority of cases, however, a core of hempen fibre is employed. Use of a lubricated hemp core in a wire rope serves two main purposes:

1. It insures protection against rust and corrosion of the inner strands.
2. It insures the maintenance of adequate flexibility with a minimum of friction when the rope is first put into service, and preserves the fibres of the core.



One form of device recommended for lubricating wire rope. The rope passes through a V-shaped wooden trough, hot lubricant is poured on it, and the excess is wiped off with a bunch of waste.

It has been said that the life of a wire line is largely dependent upon the core. This is only another way of emphasizing the need for efficient lubrication; for, the purpose of the hempen core, in addition to the functions mentioned, is to provide a medium for the absorption of the lubricant and to cushion the interior faces of the strands. Consequently, when the core becomes dry and worn, the rope no longer receives adequate lubrication. Conversely, if a wire rope in service is not lubricated at frequent intervals, the core will become excessively dry and deteriorated—to the ultimate serious detriment to the rope.

It should be noted, however, that wear in any wire rope in active service can never be wholly eliminated; for it is impossible to prevent some friction to exist between individual strands of the rope, and between the sheaves or winding drums and the rope's exterior surface. But friction—and, therefore, wear and increased bending stresses —can be minimized by selecting a suitable rope lubricant and applying it properly; and deterioration caused by such factors as water, acids, alkalies, high temperatures, or corrosive fumes can be materially lessened by the use of a lubricant possessing the qualifications essential for the particular conditions of rope use.

When a rope is bent, friction develops between the inner strands. Consequently, the use of a lubricant is necessary to decrease this friction. Since bending tends to squeeze out lubricant from the core and inner surfaces of the rope, re-application of lubricant at regular intervals becomes necessary. By using sheaves or drums of large diameter the bending of a rope will not be so sharp and, therefore, less lubricant will be squeezed out. On the other hand, small sheaves necessitate the more frequent lubrication of the rope in order to keep wear to a minimum.

**Minimizing Core Wear**

The life of the core depends largely upon its being lubricated at all times. Remember that even an axial stress on the rope causes compression—of the core: in addition, there is the deterioration resulting from the crushing action that takes place when the steel strands press into the hempen core, as the rope is wound on and off the sheave or drum. Core wear is minimized by keeping it impregnated with lubricant at all times. A dry core not only will absorb moisture, but will also deteriorate and crush quicker than a

well lubricated one—all of which affects the wearing qualities of the rope.

From the foregoing, it becomes evident that lubrication of a wire rope is necessary:

1. To retard rust and corrosion.
2. To reduce the internal friction between the individual inner strands.
3. To reduce the external wear by minimizing the friction between the outer surfaces of the rope and the drums or sheaves.
4. To retard the deterioration of the core by maintaining it in the proper state of softness and pliability.

The core on new wire rope retains quite a supply of the original lubricant but, as a further assurance that frictional wear and core deterioration will be kept at a minimum, lubricating the rope just after installation and before putting into service (particularly such ropes as have been kept in storage for some time) is recommended.

### Selection of Lubricant

It cannot be emphasized too strongly that, in order to get longest service from a wire rope, the lubricant used thereon must be selected with the class of service in which the rope is used definitely in mind. In other words, a lubricant that will prove suitable on a slow speed derrick cable will not give equal satisfaction if applied to a high speed mine hoisting rope. However, there are several qualities that should be possessed by all wire-rope lubricants, regardless of rope service, namely:

1. Ability to adhere firmly, at all times, under the heavy rubbing and scraping action of the wires.
2. Ability to penetrate between the strands to the core and to impregnate the hemp center.
3. Freedom from acids, alkalies or any other harmful ingredients that might pit or corrode the strands.
4. Ability of the film of lubricant to spread itself; in other words, it must be flexible enough in its characteristics so that the rope can pass freely over the sheaves without danger of the lubricant either coming off or opening up to admit moisture.
5. Preferably, should not evaporate or harden upon prolonged exposure to the air, nor be affected by moisture or corrosive fumes (if the latter are encountered in service.)

### Five Classes of Rope

Wire ropes may be divided into five general classes as follows:

1. Slow speed ropes operating under heavy loads.
2. High speed hoisting ropes.
3. Haulage and slope ropes run at high speeds and under heavy loads.
4. General haulage ropes and ropes of lighter duty than those of Class 3.
5. Stationary ropes exposed to moisture, corrosive fumes, or spray, etc.

Each of the above-mentioned classes demands certain particular qualifications in the lubricant used, which qualifications are not necessarily common to the other classes.

For slow speed ropes operating under heavy loads (Class 1), such as the ropes used on derricks, dredges, cranes, steam shovels, etc., a lubricant of heavy body and of adequate adhesive characteristics, applied cold, will give satisfactory results. So, too, will a straight petroleum product having a viscosity of 900 to 1100 seconds at 210°F., applied hot, prove suitable.

For high speed hoisting ropes (Class 2), such as mine shaft ropes it is advisable to use a lubricant of relatively low viscosity, possessing great pentrative and adhering qualities, and capable of saturating the rope thoroughly. Where automatic lubricating devices are utilized for applying lubricant to such cables, a light lubricant with a viscosity of 350 to 500 seconds at 100°F. will prove satisfactory. Where application with a brush is required, a lighter lubricant should be used.

For furnace hoists, derrick falls, logging ropes, coal mine slope and shaft ropes, and haulage ropes and other ropes running at high speeds and under heavy loads (Class 3), a mineral oil lubricant having a viscosity of 500 to 800 seconds at 210°F. is recommended.

For general haulage ropes and for ropes of lighter duty than those of Class 3, it is advisable to use a mineral oil of a lower viscosity (for example, 200 to 300 seconds at 210°F.) than that recommended for lubricating the ropes in Class 3 service. However, there should be no lessening in the adhering, penetrating, or lubricating qualities of the lubricant.

For stationary ropes exposed to moisture, corrosive fumes or spray, etc., either a grease or an oil can be used with equal satisfaction, provided the lubricant adheres to the rope under all conditions of service and forms a suitable protective coating. A straight petroleum product with a viscosity of 900 to 1100 seconds at 210°F. (previously mentioned as being suitable for lubricating the ropes in Class 1 service) will meet this requirement.

### General Recommendations

The following general comments are applicable to the selection of a wire-rope lubricant: The lubricant should be fluid enough to penetrate the strands and the core, but not so fluid as to run off the rope nor so viscous as merely to cover the rope.

Tar products are not absolutely waterproof, are deficient in lubricating qualities, and, in addition, usually contain tarry acids which tend to corrode the rope—especially in the presence of moisture. Further, such products, on exposure to the air, eventually harden, crack and peel off the wire strands.

Soap-thickened mineral oils (that is, greases), while they can be made to the same consistency as the average straight mineral wire-rope lubricant, are usually deficient in adhering and penetrating qualities.

The greater the speed of a rope in service, the lower should

(*Please turn to page 246*)

# NEWS *of the* INDUSTRY

### Foreign Trade Opportunities

FOREIGN trade opportunities reported by the U. S. bureau of Foreign and Domestic Commerce during the month of June include inquiries from the following sources: For enameled wire (38698) from Copenhagen, Denmark; for copper and cadmium telegraph wire (38824) from Melbuorne, Australia; for wiring supplies and lighting fixtures (38784) from Montreal, Canada; for cold rolled wire (38786) from Dusseldorf, Germany; for mild steel rivet wire and tinned steel mattress wire (38767) from Glasgow, Scotland; for rubber covered cable (38926) from Vancouver, Canada; for wiring supplies (38931) from Durazno, Uruguay; for electrical wiring supplies (38964) from Alexandria, Egypt; for hoisting cable wire (38986) from Winnipeg, Canada; for galvanized woven wire fencing (38970) from Bergen, Norway.

---

### Engineers Define Terms

A conference to discuss the terms "engineer" and "engineman," was held in the rooms of the American Society of Mechanical Engineers recently. The purpose of the conference was to prepare a statement of not over fifty words which could be submitted to the Bureau of Census as a guide for the census enumerator to decide upon the proper designation of those who might claim to be engineers. The following statement was agreed upon:

"The engineer is a man or woman of professional training or experience who applies engineering principles to research, design, construction, operation or production, or who imparts technical instruction in these fields. The professional engineer must be carefully differentiated from the machine or engine operative."

**Preliminary figures for United States electrical wire and wire product exports**
**(In dollars)**

| Article | April | | 4 months ended April 30 | |
|---|---|---|---|---|
| | 1928 | 1929 | 1928 | 1929 |
| Insulated wire and cable, iron or steel | $ 9,959 | $ 20,778 | $ 71,567 | $ 159,645 |
| Copper, bare wire | 220,052 | 256,533 | 761,708 | 1,245,378 |
| Copper, insulated wire and cable | 275,982 | 468,881 | 1,401,063 | 2,385,485 |
| Insulating material | 79,030 | 108,343 | 416,936 | 489,745 |
| Other wiring supplies and line material | 72,818 | 92,246 | 321,901 | 428,200 |

### Mexican Wire Production

THE Cia. Fundidora de Fierro y Acero de Monterrey, S. A. (Monterrey Iron and Steel Works), the principal unit of the Mexican steel industry, had a most profitable year in 1928, with increasing production in virtually every line produced and a satisfactory increase in total sales, according to the annual report to the stockholders. Several new lines of machinery were installed and the production of this company diversified thereby.

The year saw the addition of a new unit to the company's line —a wire factory with nine drawing machines being completed and set in operation in the closing months, achieving an output of 2,124 tons over the short time it was in operation. The brick factory, formerly an important unit of this company, was turned over to a separate company which undertook its operation.

---

### New Westinghouse President

F. A. Merrick, formerly superintendent of the Canadian Westinghouse Company, Ltd., was elected president of the Westinghouse Electric and Manufacturing Co. on June 25. In accepting the resignation of E. M. Herr, president since 1911, A. W. Robertson, chairman of the board of directors, announced that Mr. Herr had been elected vice chairman.

The company also announces the appointment of O. H. Escholz as manager of the Patent Department and of William G. Marshall as assistant to Vice President T. P. Gaylord. Mr. Marshall will be in charge of employees relations. Headquarters of both new appointees will be at the East Pittsburgh works.

---

Edmund F. Krause, formerly branch manager of the Los Angeles office of the Wickwire Spencer Steel Co., has taken the Pacific Coast representation for the Worcester Pressed Steel Co., George W. Prentiss & Co., and other manufacturers of wire products.

---

### Wire in Tariff Hearings

MANUFACTURERS and consumers took opposite sides June 28 on the House increase of duty on Fourdrinier wire, in testimony before the subcommittee of the Senate Finance Committee which is considering Schedule 3 of the tariff bill. Paper manufacturers, in whose business Fourdrinier wire is an essential material, urged that the old duty be retained to keep prices reasonable, in spite of the fact that most of the wire used is bought from domestic manufacturers.

Leon O. Hart, of the Driver-

Harris Company, Harrison, N. J., asked the committee for a special classification in paragraph 316 for fine, cold-drawn, nickel alloy insulated wire, which would give it a duty of 40 per cent instead of the 35 per cent ad valorem placed on insulated telephone and telegraph wire and cables. It was brought out that imports of the product total only about 1 per cent of the domestic production.

Testifying for the Advanced Bag and Paper Company, John N. Harvey, Boston, Mass., protested a new classification in the House bill, paragraph 318, making Fourdrinier wire dutiable at 55 per cent ad valorem. This wire carried 35 per cent in the 1922 act, but a court decision reduced this to 30 per cent.

The testimony of Mr. Harvey was endorsed by H. A. Sheesley, of the International Paper Company, Corinth, N. Y. A reduction in the Fourdrinier wire rate was also asked by Louis Titus, speaking for Neumeyer & Dimond, New York City. The side of the domestic producer was presented by A. M. Ferry, of the Wire Cloth Manufacturers' Association, Chicago. Hamilton Lindsay, of the Lindsay Wire Weaving Company, Cleveland, stated that his company was losing business, though one of the most successful in the industry, and that many of the smaller plants are on the verge of bankruptcy. He said the price would decline if the higher rate was retained.

Further testimony in favor of the increase was given by John F. Curley, of the Wire Weavers' Protective Association, Holyoke, Mass.

### Building and Expansion

THE Mossberg Pressed Steel Corporation of Attleboro, Massachusetts, are known throughout the wire industry as designers and manufacturers of pressed steel reels and spools, vulcanizing pans and kindred equipment. After many months of operating on a day-and-night schedule, it has become necessary to enlarge the plant facilities materially. An addition is being built which, with necessary machinery installed, will enable the output to be practically doubled.

It is expected that this addition to plant and machinery will be placed in operation sometime during the month of August.

---

New Orleans Wire Works is now in operation at 809 Decatur St., New Orleans, La. George H. Prodrasky, Sr., is president. Products will be window, skylight and machine guards, bank, office and elevator enclosures, gates, screens, cages, and other miscellaneous wire products.

### COMING EVENTS

July 1-4. Summer meeting American Society of Mechanical Engineers at Salt Lake City, Utah. Calvin W. Rice, Secretary, 29 W. 39th St., New York City.

July 8-11. Annual Convention, American Electro Platers' Society, at Detroit, Mich.

September 9-13—National Metal Congress in Cleveland, Ohio. Simultaneous meetings with the American Welding Society; Institute of Metals Division, American Institute of Mining and Metallurgical Engineers; Iron and Steel Division, American Society of Mechanical Engineers; Iron and Steel Division American Institute of Mining and Metalurgical Engineers; and American Society for Steel Treating. W. H. Eisenman, Secretary, 7016 Euclid Ave., Cleveland, Ohio.

October 15-17. Bridge and Building Supply Men's Assn. at New Orleans. Secretary, I. B. Tanner, 332 S. Michigan Ave., Chicago, Ill.

October 29. World Engineering Congress, Tokio, Japan. George W. Fuller, Chairman American committee on attendance, 170 Broadway, New York City.

December 2-6—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

December 2-7. National Exposition of Power and Mechanical Engineering at New York. Address Charles F. Roth, 420 Lexington Ave., New York City.

December 18. International Assn. Municipal Electricians at Boston. Secretary, H. N. Lang, City Hall, Orlando, Fla.

---

Marlboro Wire Goods Company, Marlboro, Mass., is adding a three-story fire proof factory building to present plant on Lincoln St. Increased demand for kitchen and bathroom fixtures in colors necessitates expansion. H. E. Moineau is president.

---

Automatic Screw Machine Co., 3419 W. 31st St., Chicago, will build a new addition at an estimated cost of $20,000.

---

Western Screw Mfg. Co., 4413 W. Kinzie St., Chicago, will build and equip a new plant adjoining the present one at an estimated cost of $100,000.

---

H. K. Porter, Inc., Everett, Mass., manufacturers of wire cutters, bolt clippers, etc., has awarded contract for an addition to be built and equipped at a cost estimated at $50,000.

---

Detroit Insulated Wire Co., 4647 Wesson Avenue, Detroit, Mich., is completing a one-story addition at an estimated cost of $40,000 with equipment.

---

Chicago Coil Spring Co., Carroll and Albany Avenues, Chicago, will build and equip a one-story addition at an estimated cost of about $40,000. The addition will provide about 10,000 feet of floor space.

---

National Wire Goods Mfg. Co., Rock Hill, S. C., has established a branch in Richmond, Va., for the manufacture of wire coat hangers. When installation of machinery and equipment is completed, it is estimated that the Richmond plant will have an output of 100,000 hangers a week.

---

The Toronto Harbor Commissioners, J. G. Langton, general manager, Harbor Commission Bldg., Toronto, Ont., has invited tenders for construction of approach piers and foundations for the new bascule type lift bridge which will be of concrete and steel construction. Tenders for superstructure will be invited shortly. Bridge when completed will cost about $380,000.

Sleeper & Hartley
TRADE MARK
REG. U.S. PAT. OFF. & PRINCIPAL FOREIGN COUNTRIES

# Practical Wire Wo

These Machines Go Into Production at O

## Continuous Rod Frame

**(No. 5—14 or 15 wire)**

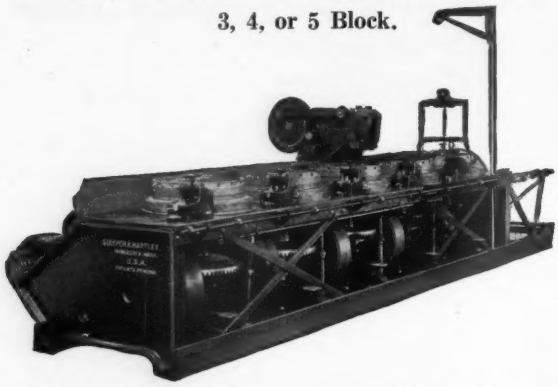
**Patented June 3, 1924—May 12, 1925—others pending**

**All Ball or Roller Bearings**

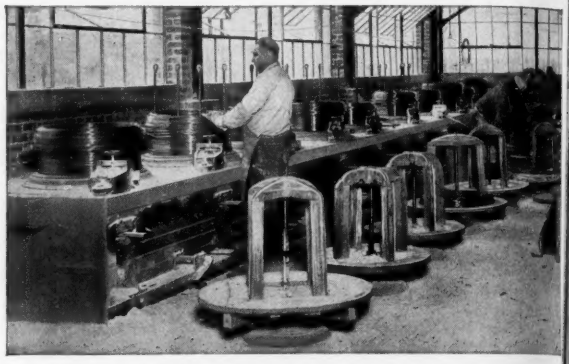
**No Differential Gearing.**

**Automatic Compensation for Speeds of Heads.**

**3, 4, or 5 Block.**



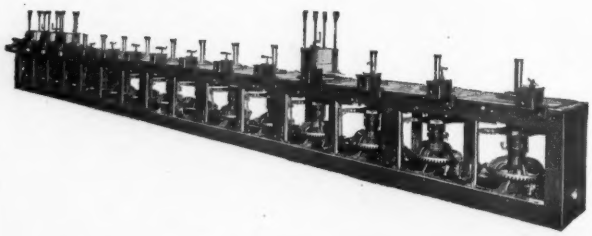
## Single Hole Drawing



### Standard Rod Frame—10 Block

**Long, Stiff Spindles, in anti-friction bearings, and equipped with friction Clutches. Powerful and reliable. Practically noiseless in operation.**

**(New Plant of Thompson Wire Co., Worcester, Mass.)**



### Heavy 16" Frame For .65 Carbon Wire
### No. 10½ to .037"

**15 Blocks: Motor driven. Silent chain. Anti friction bearings and cut gears throughout.**

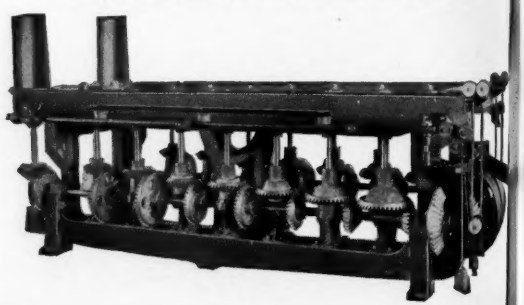
**(New Plant of Johnson Steel & Wire Co., Worcester, Mass.)**

## Double 8-Draft Fine Wire: We

**No. 22 to 36. High or low carbon wire.**

**6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. p y of ten hours.**

**Many thousands of these heads in operation**



CHICAGO TERRITORY
Neff, Kohlbusch & Bissell, Inc.

SAN FRANCISCO AND LOS ANGELES
L. G. Henes Machinery Company

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KING DOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London, E. C. 4.

# SLEEPER & H

# Working Machinery

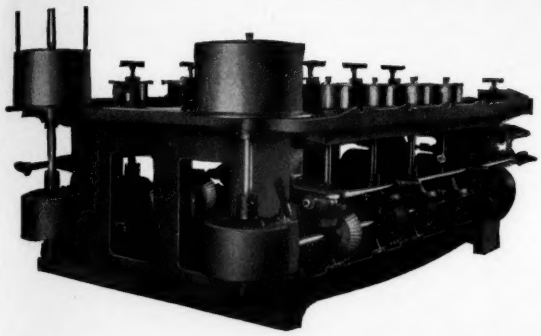
Sleeper & Hartley TRADE MARK

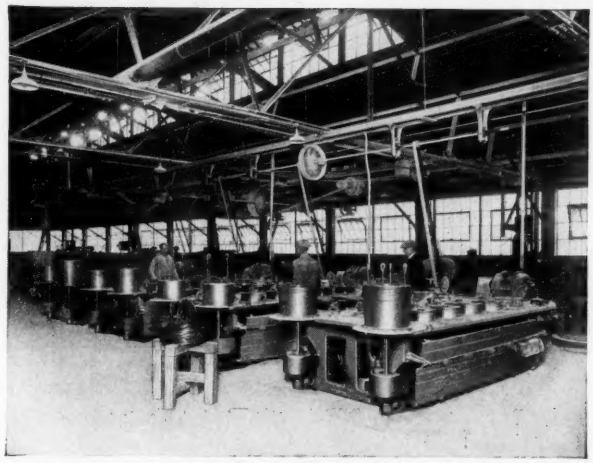
—Reducing Overhead—Increasing Production!!

## Double 5-Draft Dry, Intermediate

**No. 14 to No. 23. High or low carbon wire.**
**3 to 4 Blocks to Average Operator.**
**No. 14 to 19—4 hole, 1400 lbs. per block.**
**No. 14 to 20—5 hole, 1100 lbs. per block.**

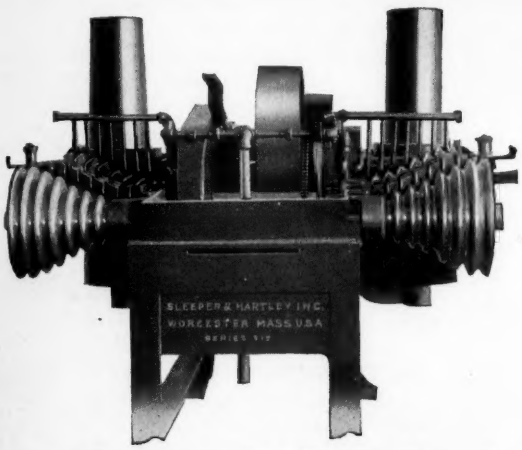
More than 300 heads of this improved model in operation



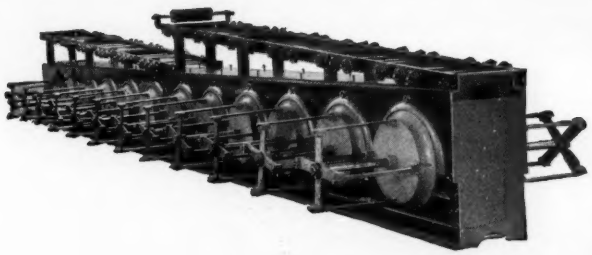


**Battery of Double Six-Draft Dry Continuous For High Carbon Wire**

Direct driven with silent chain. Cut gears throughout. Anti-friction bearings. Variable speed for finishing block.
(New Plant of Thompson Wire Co., Worcester, Mass.)




**Improved Double 8-Draft Cone Type Continuous Wet Wire Drawing Machine**



**Patenting Furnace Take-Up**

(New Plant of Thompson Wire Co., Worcester, Mass.)

Philadelphia Territory
Swind Machinery Co.

NEW YORK—Triplex Mch. Tool Co. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Tokyo. MONTREAL A ND TORONTO—Arthur Jackson Mch. Tool Co.

**ARTLEY, Inc., WORCESTER, MASS., U. S. A.**

# X-Ray Investigation of Wire

## Experiments with studies of crystallization in low carbon specimens promise possibilities of wider application for test purposes

ONE of the important papers read at the May 24th meeting of the American Iron & Steel Institute was that of Mr. F. C. Elder, Chief Metallurgist of the American Steel & Wire Company, recording the results of certain X-Ray photographs of wire, showing the crystalline structure resulting from various treatments of low carbon (.08-.10) wire. The paper was more significant for its promise of possibilities for the future than for the description of any present practical application.

It has been recognized for some time that X-rays possessed the property of diffraction under proper circumstances, the same as light rays. One condition is that crystalline boundaries produce this effect, and that by proper manipulation, either by a penetrating ray, as in the Hull "pinhole method", or by a reflected ray, certain definite "patterns" could be produced which were distinctive and capable of definite analysis. The theory is intensely mathematical, and treats of values almost ultra-microscopically minute.

### Method of Test

The method employed by Mr. Elder, to use his language, is as follows: "In this pin-hole method of characteristic line-spectrum X-rays are passed through a slit system made up of a series of lead diaphragm's each provided with a pinhole, in order to get an X-ray beam composed of rays which are parallel or as nearly parallel as possible. The specimen is mounted directly over the pinhole in the diaphragm which is the farthest from the Coolidge X-ray tube and the photographic plate is set up in a plane normal to the X-ray beam, in our case 2½" back from the specimen.

"All our specimens, except where otherwise noted, were longitudinal sections, that is,

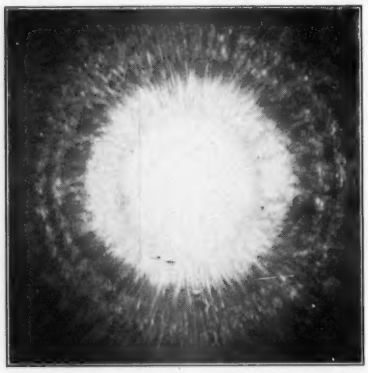


Fig. 1—X-ray photograph of annealed wire showing random distribution of crystals.

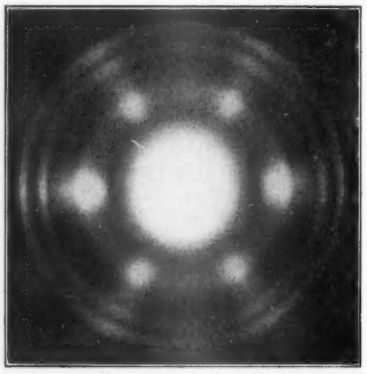


Fig. 2—Hard drawn wire, after 98 per cent reduction from annealing point, shows a more orderly arrangement of crystals.

sections taken parallel to the direction of the cold work and taken along the axis of the wire. Each specimen was carefully ground and polished down to a thickness of .006"-.001" and, after polishing, etched with acid in order to remove the surface effected by the grinding and polishing."

The result is a photograph with four distinctive areas:

1.—A white "bull's eye" the direct imprint of the primary unrefracted X-ray beam.

2.—An annular area immediately surrounding the bull's eye, the result of diffracted rays of the first degree.

3.—Two rings, less distinct, concentric with the bull's eye, caused by the selective diffraction of definite wave lengths by a crystalline plane (in this case stated to be the 110 plane), and termed K-beta and K-alpha respectively, as to the bull's eye.

4.—Various other rings which may be significant, but which may be developed only by longer exposures or greater intensity of illumination.

For the purposes of this review, only the more definite features may be described., Annealed wire shows a practically uniform "corona" with the annular area bright, and the K-alpha and K-beta lines distinct and uniform. This indicates a random and unoriented distribution of crystals, as any tendency to parrallelism would result in a concentration of rays, and therefore bright spots (Fig. 1).

### Traces Crystalization

Hard drawn wire develops six areas with increasing percentage of drafting until, with 98% reduction from the annealing point, a definite six spoked "wheel" is produced (Fig. 2) with a faint indication of a secondary 90 degree reflection. This indicated that the process of wire drawing has resulted in what is termed "preferred orientation" in that the original structure of random distribution of crystals has given way to an orderly lineup for fibering, with the great majority of crystals facing and pointing in the same direction.

Annealing restores the original random arrangement, but it is noteworthy that the greater the preceding cold work, the higher seems to be the temperature necessary.

Mr. Elder's paper treats only of low carbon wires. It is to be hoped that succeeding papers will picture the effects of varying carbons, patenting, cold rolling, tempering, and other wire mill operations.

# DIGEST *of* RECENT TRADE LITERATURE

**Few Rejects in Electric Spring Tempering.** Electrical World. February 2, 1929. P. 251.

P. N. Rugg, Industrial Heating Division, Boston Edison Company, describes an electric conveyor type tempering oven recently built by the Barber-Colman Co., Framingham, Mass., for use in the production of small steel springs of about 0.40 per cent. carbon component formerly tempered by gas. The operating temperature is 650 deg. F. and the tempering process requires about 2 minutes per batch, the capacity of the oven being about 200 lbs. per hour. This is equivalent to an hourly production of 320 springs 1 foot long, the wire being 0.012 in diameter and weighing 5-8 lbs. per foot. Springs wound from 0.007-inch, 0.009-inch, and 0.1010-inch wire are also tempered in the oven. The springs are ½ inch in diameter and are wound automatically, both right and left hand, from 8 inches to 36 inches in length. The springs are used in textile machinery and must be properly tempered and of the same coloration over the entire surface. Data is given on costs of operation and it is reported that rejects have been practically eliminated by electric tempering owing to uniform heat distribution, close temperature control, and absence of hot spots, scaling and oxidation.

---

**The New Pyrometallurgical Laboratory of the Dominion Government.** Iron & Steel of Canada, May, 1929. P. 134.

In view of the growing importance of the iron and steel industry in Canada, the Department of Mines has erected in Ottawa as an addition to its present ore testing laboratories, a new pyrometallurgical laboratory which is being equipped with laboratory scale and semi-commercial roasting, calcining, sintering, metallizing, melting, heat treating, and standard laboratory testing and metallographic equipment for conducting extensive test and research on ferrous and non-ferrous ores, metals and their alloys, especially iron and steel.

---

**The Thermal Conductivities of Copper and Nickel and Some Alloys of Nickel.** Rensselaer Polytechnic Institute Bulletin, Engineering and Science Series, No. 21. Troy, N. Y.

The thermal conductivities of alloys are constants of increasing importance in engineering designs that involve heat flow. In addition, a knowledge of these constants is of scientific interest because exact measurements serve as a stimulation for and a limitation to theoretical speculation. In this investigation by W. C. Ellis, F. L. Morgan and G. F. Sager, a method of determining thermal conductivity was used which is applicable to metals in the form of wire. The method described by R. W. King (Physical Review 6, 437, 1915) was checked for accuracy and the value of copper redetermined to check the design of the apparatus. In addition, measurments were made on two grades of nickel and the following alloys: Climax, Climax 193, Nichrome IV, Nichrome, Advance, and Monel.

---

## Trade Literature Received

### *Welding*

"Safety in Welding". Policyholders Service Bureau, Metropolitan Life Insurance Company, New York City. 16 pages. A discussion of present knowledge of welding hazards affecting the health of the operator, chiefly those created by injurious light rays and by fumes and gases produced by the action of heat evolved during the process. Accident hazards are described and preventive measures recommended.

### *Foreign Trade*

"United States Trade Promotion Agencies Abroad". Foreign Commerce Department, Chamber of Commerce of the U. S. A., Washington, D. C. 12 pages. A list of names, post office and cable addresses of American Chambers of Commerce and representatives of the United States Department of Commerce in foreign countries.

### *Factory Construction*

"Choosing the Industrial Building". National Lumber Manufacturers Association, Washington, D. C. 20 pages. Illustrated. Presents in brief, non-technical language the various performance requirements and other considerations in the use of heavy timber industrial construction. Data and discussion include such items as comparative costs of construction, amortization, heating, fire resistance, insurance and permanence.

### *Wire Belting*

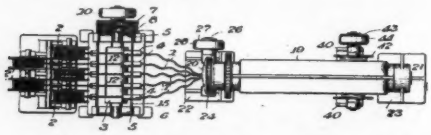
"Our New Product". Audubon Wire Cloth Company, Inc., Audubon, N. J. Illustrated folder describing spiral woven flexible wire fabrics for conveyors, flexible wire belts and aprons. The company's new product is made in plain, galvanized and tinned steel, aluminum, monel metal, bronze, brass and copper in meshes of from 1/16 to 2¼ inches and in any length or width.

### *Wire Glass*

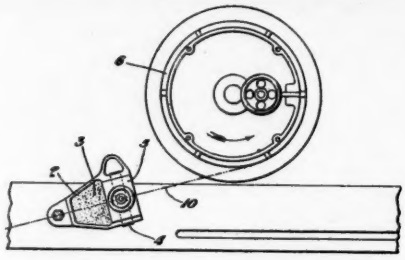
"Vitalite, the Flexible Health Glass". The New York Wire Cloth Company, 342 Madison Avenue, N. Y. C. Descriptive folder and sample of wire netting reinforced transparent window material that admits ultra-violet rays of the sun. The product is especially recommended for poultry houses, plant beds, barns and milk houses, factories, tourist camps, bungalows, etc.

# A REVIEW *of* RECENT PATENTS

**Complete descriptions and drawings of any of the patents referred to on this page may be had for twenty five cents. Address orders to Wire & Wire Products, 551 Fifth Avenue, New York City.**



**Machine and Method For Forming Cables 1,712,264**



**Method of Manufacturing Wire 1,712,348**

No. 1,712,264, MACHINE AND METHOD FOR FORMING CABLES. Patented May 7, 1929, by John R. Gammeter, of Akron, Ohio. The general purpose of this invention is to provide a practical and simplified form of machine for spiralling a series of separate strands of wire, laying them together in the form of a cable and tensioning the cable to the exact degree required to compact the strands into close formation. It is claimed that the machine and method disclosed will eliminate expensive braiding machinery heretofore used in this art.

---

No. 1,712,348, METHOD OF MANUFACTURING WIRE. Patented May 7, 1929, by James Forrest Howe, of Worcester, Massachusetts. Assignor to The American Steel and Wire Company of New Jersey. This invention relates to the manufacture of wire, and more particularly to a method of drawing wire whereby a coating of a softer metal in dry powder form is applied to the wire during the drawing operation and provides an improved wire, while at the same time eliminates the necessity for using soap, oil, or other lubricants heretofore used to lubricate the wire prior to passing through the reducing dies.

---

No. 1,714,094, WIRE CUTTING MACHINE. Patented May 21, 1929, by Melvin D. Kilmer, of Cleveland, Ohio. Different sizes of wire may be cut different lengths by an easy adjustment of this machine. Means are also provided for straightening the wire and for feeding the same in proper alignment with the cutting means.

---

No. 1,714,096, WIRE STRAIGHTENING AND BURNISHING ARBOR. Patented May 21, 1929, by George F. Matteson, of Rockyhill, Connecticut. Assignor to The F. B. Shuster Company. of New Haven, Connecticut. This arbor has an opening extending lengthwise therein and a hole intersecting the opening on opposite sides thereof, a pair of plugs located in the hole in a line diametrically through the arbor, and a pair of rollers rotatably mounted in the plugs to receive a wire between them.

No. 1,714,169, WIRE TESTING DEVICE. Patented May 21, 1929, by Russell E. Irish, of Dormont, Pennsylvania. This invention relates to a device for estimating the pressure exerted by wire, and particularly to a device for estimating the pressure exerted by flexed wire when used in orthodontia or the straightening of teeth.

---

No. 1,714,253, JOINT FOR WIRES OR CABLES. Patented May 21, 1929, by Theodore Varney, of Sewickley, Pennsylvania. Assignor to Aluminum Company of America, of Pittsburgh, Pennsylvania. In the twisted tube method of joining wires it has been found that the joint will develop more strength in the cable if it can be so twisted that the pitch of the twists will be shorter near the middle of the tube than at the ends. The present invention proposes to utilize in a joint of this kind, a tube so designed that when the wrenches are applied to the ends thereof and the tube twisted, it will have the inherent property of twisting, in such manner that the pitch of the twist will vary at different points in the tube, being shortest where it is desired to develop the greatest pressure. This is preferably done by making the walls of the tube thicker at some points than at others.

---

No. 1,712,541, WIRE SPLICING MACHINE. Patented May 14, 1929, by John W. Wright, of Philadelphia, Pennsylvania. Assignor to American Telephone and Telegraph Company of New York. This invention relates to wire twisting apparatus and particularly to means for splicing electrical conductors such, for example, as the wires of telephone cables. The apparatus is characterized by means for controlling the length of the twisted portion of the conductors, and also by means for automatically limiting the number of twists that may be inserted therein.

---

No. 1,712,843, STITCHING MACHINE. Patented May 14, 1929, by George L. Richardson and Walter Pabich, of Chicago, Illinois. Assignors to Latham Machinery Company, a corporation of Illinois. This machine is adapted to stitch a plurality of wire staples in relatively close proximity in respect to each other, and is described as an improvement over the patent issued in the name of Ernest Leschhorn, No. 1,583,935, granted May 11th, 1926.

---

No. 1,714,480, WIREWORKING MACHINE. Patented May 21, 1929, by John J. Thatcher, of Wetherfield, Connecticut. Assignor to The F. B. Shuster Company, of New Haven, Connecticut. This invention relates to the class of machines employed for the purpose of straightening wire and for cutting it into definite lengths. The cutter mechanism includes a carrier and its support, the carrier having a cutting die to receive the wire, a cutter lever pivotally supported on the carrier and having a die cooperating with that on the carrying member, means other than the pivot of the lever for slidably supporting it, a cutter lever actuating member, and means for feeding a wire to the cutter mechanism whereby the carrier is slid upon its support.

---

No. 1,713,314, METHOD OF SECURING WIRES TOGETHER. Patened May 14, 1929, by Walter Bruce Wills, of Baltimore, Maryland. This invention relates to the manufacture of wire articles such as soap dishes, dish-drainers and the like, and has special reference to the method of joining wires, particularly where the wires to be united are of different diameters. The method consists in partially penetrating and laterally spreading the wire of greater diameter by pressing a recess diametrically into the side thereof, inserting the end of the wire of smaller diameter into the recess, and finally compressing the first mentioned wire circumferentially at the opposite sides of the recess to restore the wire to the original diameter thereof.

---

No. 1,712,876, WIRE THREADING BIT. Patented May 14, 1929, by John V. Dolezal, of Beeville, Texas. The general object of the invention is to provide a bit that is primarily designed for boring aligned holes in the spaced portions of a concrete form and includes means for threading a tie wire through the openings, without removing the bit therefrom.

WE RECEIVED TWELVE INQUIRIES * FOR A COPY OF

"Why Shipping Reels

with

Wooden Drums Go Bad ?"

Were you one of the twelve?

If not—you are missing some vital facts.

ASK FOR YOUR COPY TODAY

R. B. Hayward Co.

1714 Sheffield Avenue

Chicago, U. S. A.

Manufacturers of

"RED HEAD" SHIPPING REELS MACHINE

for the Wire & Cable Industry

*ONE FROM JAPAN

## Paper Test for Defective Coatings

A PINHOLE in a protective coating whether nickel, copper or chromium, allows the corroding, eroding oxydation to destroy the entire surface. In tin plating it is very important that a complete protective coating has been deposited.

There are many ways in which each plater has tested his work. Most of them have been time consuming and almost always destroyed the sample. It has been the custom of electroplaters to roughly test the finished plating by exposing it to the salt spray test, or weather the sample in a damp atmosphere for months at a time.

There has recently been developed a simple test paper for detecting the presence of pinholes in protective coatings, whereby tests can be made quickly and without injuring the test piece.

This indicator called "Ferracco Test Paper" (Pat'd) is a sheet 22x17". It is coated with a mixture of potassium ferrocyanide, sodium chloride and gelatine, in certain proportions. When the exposed metal (copper, brass or iron) comes in contact with this sensitized paper, a colored complex dark blue cyanide is formed and indicates the position and the size of the pinhole. The blue spots indicate pinholes down to an iron base, while brown spots indicate those to a copper or brass base.

Where a sheet of iron or steel has been coated with copper and then nickel, both colors are developed by the paper. A brown spot indicates a pinhole through the nickel to the copper, while a blue spot indicates a break through both coatings to the iron or steel base.

The head of the laboratory procured a test piece of tin plate two feet square. It was an average looking sheet, that to the eye showed no pinholes. All possible grease and dirt were cleaned off, using a cotton swab dipped in benzol. A sheet of Ferracco paper smaller in size than the sample was thoroughly moistened with distilled water and firmly and evenly pressed against the tin-plated surface.

Paper Record of Pinhole Defects

The blue spots that indicate the position of the pinholes began to show in about five to ten minutes, even through the reverse side of the test paper. The paper was allowed to remain twenty minutes when it was removed and thoroughly washed and dried. This sheet of test paper then became a permanent record of the test.

With slight variations in the manipulation of the test paper, other protective coatings are tested for pinholes. In chromium and nickel plating on copper and brass, it was found best to moisten the paper with a solution of ammonium citrate and ammonium carbonate instead of distilled water. When the base metal is iron or steel, distilled water alone should be used, otherwise the blue stain will be retarded in its formation.

To test over-buffed plating, i. e., plating where excessive buffing has thinned the plate almost to the base, Ferracco paper plainly shows areas of light brown or blue.

**Metal Spools for Wire Drawing**

**Metal Spools for Annealing**

**Metal Lined Spools for Shipping**

**Metal Lined Reels for Shipping**

**Hubbard Spool Co.**
**1622 Carroll Avenue**
**Chicago**

**HOTEL MONTCLAIR**

Room and Bath
Tub and Shower
$3 to $5
per day

For 2 persons
$4 to $6
per day

Suites
$8 to $12
per day
Special Monthly and Yearly Rates

49th to 50th Sts.
Lexington Ave.
NEW YORK CITY

800 Rooms
Each with Tub and Shower

*Radio in Every Room*

3 minutes' walk from Grand Central. Times Square, Fifth Avenue Shops important commercial centers, leading shops and theatres nearby. 10 minutes to Penn. Station.

*Grand Central Palace only 2 short blocks away*

S. Gregory Taylor
*President*

Oscar W. Richards
*Manager*

**Broden Construction Co.**
*Wire Mill and Cold Rolling Equipment*
10255 Harvard Ave.
CLEVELAND, OHIO.

**WIRE DRAWING DIAMOND DIES**

Over 30 years experience in this line. The best equipped establishment in America with modern methods and machinery.

New way for re-inforcing the diamond.

(U. S. Patent 1,624,027. April 12, 1927.)
Tel. Webster 5105. Cable Address: Krauseco

**F. KRAUSE & CO., Inc.**
250-252-Ogden Ave.
JERSEY CITY, N. J.

*"The House of Service"*

**BELLET & BOUVARD**

Manufacturers of

**DIAMOND DIES**

Factories { Trevoux / Les Abrets } France

New York Office 315 Fifth Ave.

(*Continued from page 239*)

Another use for this test paper is the detection of minute holes in thin metal foil. The foil is laid on an iron plate and the paper used as in the tin plate test. Blue spots will show the location of pinholes in the foil.

Ferracco Pinhole Test Paper is simple to manipulate, saves time and material and leaves a permanent record for research files and production control data.

It is now being supplied by Fisher Scientific Company, Pittsburgh, Pa.

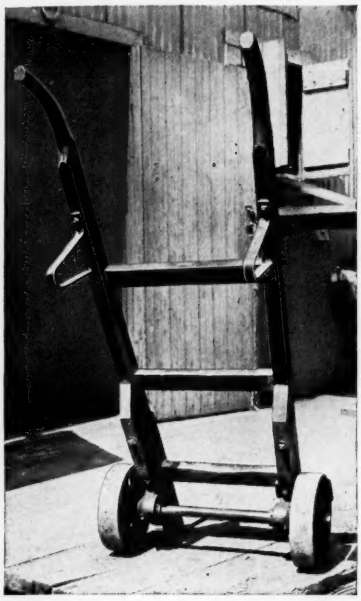
---

### New Electrode Holder for Metallic Arc Welding

THE Lincoln Electric Company, Cleveland, Ohio, announces an improved type of electrode holder for metallic arc welding designed for greater operator convenience. The holder consists essentially of a powerful clamp to hold the welding electrode firmly while welding and with an easy release feature which permits changing electrodes quickly. The handle grip is designed for easy holding and it is claimed that the holder operates exceptionally cool, because the welding current is carried from the point of cable entry to the copper jaws by copper strips of low resistance.

In the older types of holders, the high amperage welding current was carried though the steel frame of the holder itself and uncomfortable heating frequently resulted under continuous service. The copper tips on the jaws reduce the sticking of the electrode to the jaws resulting in faster and easier change of electrodes and longer life for the holder. The shape of the holding clamps has been altered to give greater compactness to permit work in close corners. All metallic parts of tarnishing cadmium plating. this holder are coated with non Each holder is packed in an individual carton which facilitates shipping and storage. The holder is known as the Improved-Type T Electrode Holder.

## How To Make a Ball Bearing Hand Truck

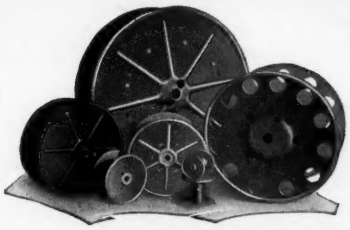


Hand push truck on which single ball bearing pillow blocks replaced plain bearings.

HAND TRUCKS, like loose pulleys, are the orphan Annies of the average plant. They don't cost much to start with, so nobody thinks they're worth taking much trouble about—a hand truck's a hand truck and you can't make it anything else.

But ask the fellows that have to push them around. They'll tell you that some trucks are hard to push and some are easy—and if you check them up, you'll find it's the wheel bearings that make the difference between the easy ones and the hard ones. The ones with plain bearings take about twice the effort that the ones with anti-friction bearings do—with the result that they generally only carry about half the load. The lift truck manufacturers found by tests that bearing friction made a big difference in the load it was possible for a man to drag—with the result that practically all lift trucks today are equipped with anti-friction bearings.

Up in New York state a number of feed mills got the idea

**Strong Enough to Stand the Strain**

**Light Enough for Easy Handling**

Apco Mossberg reels combine extreme light weight with extra strength and long wear. They are made of pressed steel, scientifically braced and reinforced to give great strength without great weight.

They are cutting costs in many operations of wire working, handling and shipping.

Let us work out the sizes and types of reel, spool or bobbin that will fit in with your needs.

**APCO MOSSBERG CORPORATION**

13 Lamb St., Attleboro, Mass.

Specialists in development of steel reels for annealing, vulcanizing and stranding; also bobbins for wire weaving.

**"BALLOFFET"**

Accurate

Dependable

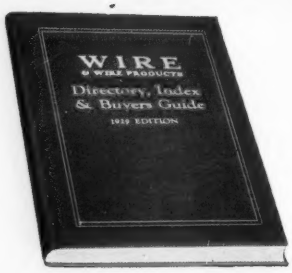
*"The quality die"*

*Our experts will solve your die problems*

**Balloffet Diamond Wire Dies Co., Inc.**

342 Madison Ave. New York City

New York Lagnieu (France) Trevoux (France)




## ¶ Below is a typical listing from the 1929 Directory

*MACHINERY: WIRE DRAWING*

**AMERICAN INSULATING MACHY. CO., Philadelphia, Pa.**
Bates Mfg. Co., Joliet, Ill.
**BERNITZ, J. L., 25 Beaver, NYC**
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Broden Construction Co., Cleveland, Ohio
Brown Engine & Machine Co., Fitchburg, Mass.
Burlingame Machine Co., Worcester, Mass.
Farnham Mfg. Co., Buffalo, N. Y.
General Engineering & Supply Co., 160 5th Av., NYC
Humphrey & Sons, Joliet, Ill.
Leiman Bros., 23 Walker, NYC
Mackenzie's, Duncan, Sons Co., Inc., Trenton, N. J.
**MORGAN CONSTRUCTION CO., Worcester, Mass.**
**NATIONAL-HARRIS WIRE CO., Newark, N.J.**
New England Wire Machy. Co., New Haven, Conn.
Richard Mfg. Co., Bloomsburg, Pa.
**SLEEPER & HARTLEY, Inc., Worcester, Mass.**
Somerville, Wm. E., & Co., Coal City, Ill.
Standard Machinery Co., Auburn, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
**TORRINGTON MFG. CO., Torrington, Conn.**
Treadwell Engineering Co., Easton, Pa.
Universal Hoisting Machy. Corp., Buffalo, N. Y.
Universal Wire Machy. Co., New Haven, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

# SPECIAL OFFER

**to new subscribers to**

# WIRE & Wire Products

**a copy of the 1929 Edition of the Annual Directory, Index & Buyer's Guide**

THE second annual edition of this Directory is the only reference work of its kind for bare and covered wire makers, fabricators of wire products, and sources of supply for wire and wire forming mill equipment.

Ove eight hundred classifications, alphabetically arranged, cover everything used in the making and forming of all kinds of wire. The listings range from Abrasives to Zinc Wire.

### WHO MAKES IT?

The second annual edition, greatly enlarged and improved, is the only complete and up-to-date directory of sources of supply for:

**Bare and Covered Wire in All Metals**
**Machinery, Supplies and Equipment for Wire Drawing and Forming**
**Lists of Industrial Users of Wire**

The book is a handy size for reference, 6¼x9¼ inches, printed in clear type on heavy paper, bound in stiff boards and covered with dark cloth that will withstand the wear and tear of shop use without getting soiled. Use the coupon below for convenience in ordering.

---

Wire & Wire Products
551 Fifth Avenue, New York City

You may send us a copy of Wire & Wire Products Annual Directory, Index & Buyers' Guide, 1929 edition, and enter our subscription to Wire & Wire Products for one year (12 issues).

☐ Remittance ($5.00) enclosed herewith.
☐ Payment will follow on receipt of bill.
} Check one

Name .....

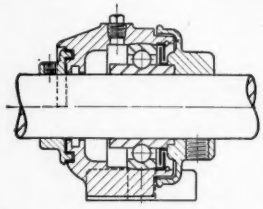
Address .....

City ..... State .....

(*Continued from page 241*)

that if they could put ball bearings on their hand push trucks they could increase the number of bags carried, at the same time cutting down maintenance for oiling and repairing worn bearings. As a result of this demand a Fafnir engineer worked out the application which is used on the truck illustrated herewith.

The original square, dead shaft was replaced by a new 1 3/16″ round shaft. This shaft was mounted in two Fafnir Single Self-Aligning Pillow Blocks bolted into seats cut in the wooden frame of the truck, thus making a live shaft application running on ball bearings.



**Fafnir Single Self-Aligning Pillow Block with double dust seal.**

To give a positive drive of the shaft, one wheel should be locked tight on the shaft end. The other wheel is preferably bored out enough to fit a little loosely so that it will slip on the shaft in turning corners, thus preventing wheel drag. There will be enough friction between this loose wheel and shaft so that there will be no wheel slippage on straight going, shaft and wheels revolving as one in the ball bearings.

Another possible and more orthodox mounting would be to put ball bearings in the wheel hubs, thus retaining the live wheel which offers no problem in turning corners. As this mounting is more expensive and is also dependent on a fairly large wheel hub, it is less practical, however, particularly as the mounting above has given entire satisfaction, making the truck push far more easily and eliminating greasing and bearing repairs.


## Lessens acid consumption

TO conserve acid, reduce pickling time and to insure improved quality, wire should be cleaned thoroughly before pickling. By using Oakite materials and methods, you can be certain that the cleaning is not only thorough but quick and economical as well.

Oakite cleaning removes the grease, oil and dirt that hamper acid action and cause rapid consumption of acid strength. Leaving wire free from film and dirt, Oakite cleaning allows acid to work uniformly and without hindrance.

Let us send our nearest Service Man to your mill to give you additional information on Oakite wire cleaning materials, methods and economies. Write us and he will call. No obligation.

*Oakite Service Men, cleaning specialists, are located in all the leading industrial centers of the United States and Canada*

Manufactured only by
OAKITE PRODUCTS, INC., 52A Thames Street, NEW YORK, N. Y.

**OAKITE**
TRADE MARK REG. U.S. PAT. OFF.
*Industrial Cleaning Materials and Methods*

**VIANNEY**

**Famous Wire Drawing Diamond Dies**

**Made on a quantity production basis, in the largest die plant in the world, these dies, famous by their uniformity and accuracy of finish, can be delivered to you, at once, in small or large quantities, at very reasonable prices, from now on.**

**VIANNEY**

**Famous Wire Drawing Diamond Dies**

**100 5th Ave., New York**

Illustration shows Model 2L-00, 13 die Breguet High-Speed Wire Drawing Machine, which draws No. 36 Brown and Sharpe Gauge and finer sizes of copper wire at a finishing speed of 4000 to 4500 feet per minute.

EST. 1865 AIMCO INC. 1915

"American" INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

517 Huntington St.

PHILADELPHIA PENNSYLVANIA U.S.A.

SEND FOR CATALOG

EXCLUSIVE AGENT FOR the United States, Canada, Mexico, Central and South America of the

BREGUET HIGH-SPEED WIRE DRAWING MACHINES

Patents Applied For in the United States. Patented in France and Great Britain.

SEND FOR CATALOG



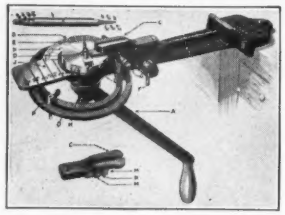
KILMER LITTLE GIANT WIRE FORMER

Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.

Adjustable for No. 3 to No. 24 Gage Wire.

The cut on the left shows a few of the thousands of the forms made on this FORMER

Price $50.00



Patented April 2, 1918

M. D. Kilmer & Co.

Cleveland, Ohio, U. S. A.
Box 237, Station B.

PATENTS
TRADE-MARKS
SERVICE

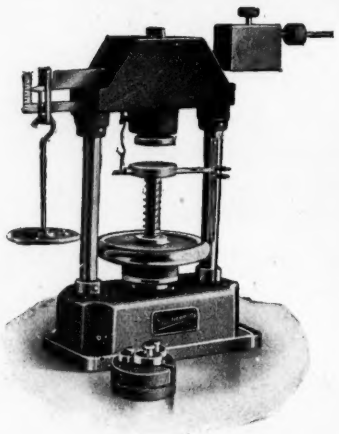
Without charge or obligation, we will inform you on any questions you may put to us touching on patent, trade-mark and copyright law. You may ask: "Should I protect myself by patent, or register under the trade-mark or copyright laws? What kind of a patent should I obtain?" and many other questions that may occur to you. These are vital points to consider and questions will be cheerfully answered.

**Evidence of Conception**

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request.

**LANCASTER & ALLWINE**
473 OURAY BUILDING
WASHINGTON, D. C.
Originators of forms, "Evidence of Conception."


## New Spring Testing Machine



MAKERS and users of springs of all kinds have long been without a practical machine sufficiently sensitive for dependably testing highly sensitive small springs. What is vitally important also is that large quantities of such springs may be tested at low cost. Elasticometer R-25 has been designed to fill these requirements by Coats Machine Tool Co., Inc., 110 W. 40th St., New York City.

The knife-edge operated scale is located in the upper housing and has a ratio of 1 : 10. Drive is through screw and hand-wheel located in the base of the machine. The load is determined by placing loose weights on the weight beam. The scale, graduated in 1/32", shown on the right-hand pillar indicates the actual length of the spring either in its compressed or elongated state. Tolerance markers, arranged on this scale, aid quantity inspection. The lower compression plate is equipped to take centering pins which will prevent deflection of small compression springs.

On the left-hand side of the upper compression plate the tension hook is shown for attaching tension springs. The slideably arranged balance weight on the upper right is used for balancing the machine before use. Re-establishment of balance, after application of load, is indicated by the pointer located above the holder.

### The Magnetic Analysis of Wire

(*Continued from page 229*)

clusions) are super-imposed on this wave form proper, as is indicated by arrows on the oscillograms in the cut. Whenever two oscillograms are taken under the same magnetic conditions on the same kind of wire, then all the physical properties are the same.

These oscillograms were made of a single length of wire only ten feet long cut out of a bundle of about 300 feet long and prove how much of a variation may occur in any single property in such a short length. This also reveals why a short length of wire taken from a coil and tested by the old methods is entirely unreliable. The speed of magnetic testing is so rapid that it is possible to test every inch of a coil of wire in less time than a short length can be taken from the end of a coil and tested by the old methods, and at the same time none of the material is destroyed or altered in any way.

### A Standard for Each Wire

Another important factor in using the style of equipment illustrated in the accompanying cut is that each wire makes its own standard. It is therefore possible to pass wire of varying chemical specifications or methods of manufacture through the equipment one right after the other without any delay. No specially and previously prepared standard is necessary. The magnetic testing of wire is now on a practical commercial basis both for laboratory testing, research work and production purposes. The wire can be tested faster than it is possible to draw it. The wire can be repassed through the equipment and exact duplications of the previous test duplicated in every case. It is also possible to stop the wire in its passage through the equipment and observe the same oscillograms that are continuously changing during the rapid passage of the wire.

MOSSBERG PRESTEEL PRODUCTS

# Annealing Reels

## Electrically Welded

Patented

INTENDED for annealing copper wire. Each reel is carefully welded into a homogeneous mass. There are no rivets.

The reel shown has friction sheave and may be taken directly from oven to stranding machine. Saves one rewinding operation.

*Send for Catalog*

**MOSSBERG**
PRESSED STEEL CORPORATION
Attleboro — Massachusetts — U. S. A.
Dallas, Texas Greenville, S. C.

# STEELSKIN

REG. U. S. PAT. OFFICE

For High or Low Carbon Wire

## WIRE DRAWING SOAPS

Established 22 years.

R. H. MILLER CO., Inc. Homer, N. Y.

## WIRE INSULATING, STRANDING AND CABLING MACHINERY

## NEW ENGLAND BUTT COMPANY

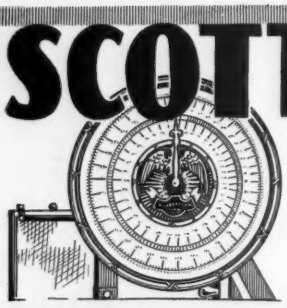
Office and Factory
304 Pearl St., Providence, R. I.

Western Office
140 So., Dearborn St., Chicago, Ill.

**We build a complete line of Stranding Machines, Cabling Machines, Closing Machines, Rubber Strip Covering Machines, Measuring Machines, and Other Allied Machines for the Wire Trade.**

OUR WIRE MACHINERY CATALOGUE SENT ON REQUEST

SCOTT



HORIZONTAL & VERTICAL TESTING MACHINES FOR WIRE

Give visible reading and graphic charts showing strength, stretch, elongation and action under stress. Used to establish standards governing purchasing and manufacturing.

HENRY L. SCOTT Co.
PROVIDENCE, R.I.

TESTERS

AMERICAN
PRESSED STEEL
REELS

PRACTICALLY INDESTRUCTIBLE
STANDARD TYPES 2½ IN. TO 8 FT.
SPECIAL TYPES MADE TO ORDER
WRITE FOR CATALOG

THE AMERICAN PULLEY CO.
PRESSED STEEL
PULLEYS HANGERS HAND TRUCKS
MISCELLANEOUS STAMPINGS
4200 Wissahickon Ave., Phila., Pa.

## Wire Products in Aircraft Industry

(*Continued from page 227*)

### Conclusion

The foregoing should give a good general picture of the use of wire products in the aircraft industry. It represents the major general uses, but by no means represents the new, special and unusual uses that occur day by day for specific purposes. These naturally are and should be handled as exceptional and individual cases.

It is to be noted that in most cases the wire products used are commercial, but it is reasonable to expect that as aircraft production expands and becomes even more exacting, a demand will likely be created for closer tolerances and greater physical properties than are prevailing in the strictly commercial product. This may be a long time coming, but as weight saving concentrates more and more upon the very small products used in great numbers, it will naturally center on the wire products, due to their very extensive use in aircraft construction.

---

## The Selection and Application of Wire Rope Lubricant

(*Continued from page 231*)

be the viscosity of the lubricant used on the rope. Wherever possible, it is best to utilize a thicker, semi-plastic lubricant and to apply it hot in a thinned condition, rather than to apply cold a more fluid lubricant. Where field conditions are such that cold application only is practical, then a chemically neutral rope lubricant should be used. Do not use crude oil, sin, in most cases, it is chemically injurious to the core and steel in the rope.

Where the rope must function under excessive abrasive conditions, such as in sand and

A. WALDECK & COMPANY
WIRE GAUGES AND
FINE STEEL WIRE DIES
7607 Broadway, Cleveland, Ohio

AUTOMATIC
Wire Working Machinery
FOR SALE
SECOND HAND ONLY

| | |
|---|---|
| Paper Clip Machines | Wire Nail Machines |
| Tack Machines | Spring Machines |
| Screw Pointers | Chain Machines |
| Screw Eye Machines | Rivet Machines |
| Shavers & Slotters | Cut Nail Machines |
| Riveting Machines | Draw Benches |
| Wire Pointers | Bull Blocks |
| Wire Rolling Mills | 4 Slide Wire Machines |
| Headers of all kinds | Wire Cutters & Straightners |
| Bolt & Nut Machines | |
| Tapping Machines | Staple Making Machines |
| Cotter Pin Machines | |

Roll Thread Machines

JESSE ATHERTON
24 CALENDER STREET
PROVIDENCE, R. I.

Orders-Inquiries

60 Pages Send for FREE Copy

Can be Secured by MAIL

POLK'S REFERENCE BOOK and Mailing List Catalog

Gives counts and prices on over 8,000 different lines of business. No matter what your business, in this book you will find the number of your prospective customers listed.
Valuable information is also given as to how you can use the mails to secure orders and inquiries for your products or services.

Write for Your FREE Copy
R. L. POLK & CO., Detroit, Mich.
Largest City Directory Publishers in the World
Mailing List Compilers—Business Statistics
Producers of Direct Mail Advertising

The Waterbury Wire Die Co.

Diamond, Composition and CHILLED IRON DIES
Waterbury, Conn.

gravel quarries, select a lubricant having high surface-protective ability in addition to lubricating, adhering and penetrating qualities.

**Application of Lubricant**

Selecting a wire-rope lubricant with care means little, unless the lubricant chosen be judiciously applied. As previously mentioned, applying the lubricant hot is recommended practice; for, thereby, the compound will penetrate and then cool to a plastic filler, thus preventing the entrance of water and serving to preserve and to lubricate the inner wires and core. This can best be done by slowly passing the rope through a heated bath of the oil.

Another method, though less satisfactory—being wasteful of lubricant and is, therefore, recommended only when conditions are such that immersion is impracticable, consists in placing a drum of the lubricant, warmed by a steam-heating coil within the drum, above the rope and then allowing the lubricant to run out on to the rope through a suitable outlet valve. A brush for spreading should be placed, with bristles up, below the flow of lubricant and in adjustable contact with the rope.

Under no conditions is hand application of lubricant to wire rope entirely satisfactory, but it is better than no lubrication at all. In applying lubricant by hand, several methods are in use. In all of them best results are obtained if a piece of sheepskin, wool side turned in, is employed; otherwise, a bunch of waste. These methods are feasible only when the rope can be sufficiently slowed down.

In the case of vertical and inclined ropes, lubrication can be accomplished by permitting the rope to move slowly through lubricant-soaked waste or sheepskin, which can be either held in the hands of the workmen or bound in place. With horizontal ropes, in slow motion, the lubricant can be poured with a dipper over the rope, catching the excess in a bucket beneath, and "working in" with sheepskin or waste placed back of the point where the lubricant is

"PREMIER"
Trade Mark Reg. U. S. Pat. Off.

Diamond Die USERS Report

- - - - *Less interrupted production*
- - - - *Less repair work*
- - - - *Less replacements*

You, too, can get these same results by using "Premier" Diamond Dies—The dies that draw true to expectation any metal in any size suited to Diamond Die Drawing.

*Write us for further information.*

DRIVER-HARRIS COMPANY
HARRISON, NEW JERSEY
Chicago - Detroit - Morristown,N.J. - England - France
*Alloy Makers since 1899*

WIRE DRAWING
Machinery and Equipment
ROD FRAMES—16" FRAMES AND 8" FRAMES—TAKE-UP FRAMES
WIRE POINTERS—PULLER TONGS
General Castings For Wire Mill Use
CIRCULARS ON REQUEST
E. J. Scudder Foundry & Machine Co.
TRENTON, N. J.

ERNST JELLINGHAUS,
VOERDE i./Westf. GERMANY
Werkzeug-und Maschinenfabrik
Netting Pinions for Wire Netting Machinery
(For hexagon and triangular netting) made from a Special Steel of about 70—80 kg solidity, and
hardened Screws (bushes for same)
First class workmanship, in all sizes wanted, as per sample or drawing.

# URDIKA

## ELMARID

*The most improved metal composition die.*

Manufactured in sizes ranging from .020" to .250"

STEEL SET

## DIAMOND DIES

Highest Quality

Accurate Size Smooth Draw

# URDIKA
## WIRE DIE WORKS

125 Fulton Street New York City


poured on. Another method consists in having the rope pass through a V-shaped wooden trough located on the ground, pouring the hot lubricant on the rope, and wiping off the excess with a bunch of waste held near the front of the trough.

Hand application of lubricant to wire rope at best is a messy job, and if there is much rope to be lubricated or lubrication at frequent intervals is necessary, it is advisable to use special appliances (which can be readily made), whereby messiness and waste of lubricant will be eliminated. In designing such devices, it should be borne in mind that, if at all possible, it is more practical and economical to lubricate a rope without removing it from service. The accompanying illustration shows how such devices may be built.

**Frequency of Lubrication**

Attention is once more called to the fact that the initial lubrication is not permanent; therefore, the rope should be lubricated after installation and before being used—more especially so if it has been in storage for a year or more.

Thereafter, the frequency of lubrication will depend upon service conditions. So long as the rope is pliable and shows evidence of lubricant in the crevices between strands, it does not require such frequent lubrication. In general, the heavier the duty, the higher the operating speeds, the greater the number of small bends, or the more deteriorating the atmospheric or fluid conditions, the more frequently should lubricant be applied.

A wire rope that is to be taken out of service and stored should be well lubricated, and the outer surfaces given a thorough protective coating, before being put away. Remember—that it is just as feasible to expect the average automobile engine to function without oil and without damage to the engine, as to expect a wire rope to have a long life without the use of a carefully selected lubricant, properly applied.

# BUYERS' GUIDE

**For more complete information, consult the annual Directory, Index & Buyers' Guide.**

**BAKERS**
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

**CLEANING COMPOUNDS**
Oakite Products, Inc., N. Y.

**CRANES**
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

**DIES—Chilled Iron**
Waterbury Wire Die Co., Waterbury, Ct.

**DIES—Diamond**
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Bellet & Bouvard, N. Y.
Cochaud Wire Die Co., New York.
Detroit Wire Die Co., Detroit, Mich.
Driver-Harris Co., Harrison, N. J.
F. Krause & Co., Inc., Jersey City, N. J.
Union Wire Die Corp., New York, N. Y.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Works, New York.
Waterbury Wire Die Co., Waterbury, Ct.

**DIES—Repairs & Re-Cutting**
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Bellet & Bouvard, N. Y.
Cochaud Wire Die Corp., New York.
F. Krause & Co., Inc., Jersey City, N. J.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Wks., N. Y.

**DRAWING COMPOUNDS**
Oakite Products, Inc., N. Y.

**FURNACES—Wire Annealing**
Vaughn Machinery Co., Cuyahoga Falls, O.

**GAUGES—Wire**
A. Waldeck & Co., Cleveland, Ohio.

**LATHES—Die Reaming**
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

**LOOMS—Wire Weaving**
M. A. Irmischer, New York.

**LUBRICANTS—Wire Drawing**
Adam Cook's Sons, Inc., New York City.

**MACHINERY—Armoring (Cable, Wire, Hose)**
J. I. Bernitz, New York.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Bundling**
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson.

**MACHINERY—Cutting**
J. I. Bernitz, New York.
The F. B. Shuster Co., New Haven, Conn.

**MACHINERY—Coiling**
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Chain Forming**
J. I. Bernitz, New York.
M. A. Irmischer, New York.

**MACHINERY—Electric Chain Welding**
J. I. Bernitz, New York.
M. A. Irmischer, New York.

**MACHINERY—Forming**
J. I. Bernitz, New York.
M. A. Irmischer, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. D. Kilmer & Co., Cleveland, Ohio.

**MACHINERY—Gem Clip**
J. I. Bernitz, New York.
M. A. Irmischer, New York.

**MACHINERY—Insulating**
American Insulating Machinery Co., Phila.
New England Butt Co., Providence, R. I.

**MACHINERY—Nail**
J. I. Bernitz, New York.
M. A. Irmischer, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Pointing**
M. A. Irmischer, New York.
Morgan Construction Co., Worcester, Mass.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrell Foundry & Machine Co., Waterbury, Conn.


## WIRE DRAWING AND THE COLD WORKING OF STEEL

**By Alastair T. Adam, A. R. T. C.**
*(Associate, Royal Technical College, Glasgow)*

**The only book of recent years dealing exclusively with the problems of cold working and wire drawing. Written by a leader in the field. 212 pages. Cloth bound boards, 7½x10 inches. Profusely illustrated from photographs. Indexed. Price: $13.00 a copy, carriage prepaid.**

*Contents*

I. Introductory
II. Wire Drawing
III. Wire Drawing: The Cold Working Operation
IV. Cold Rolling and Other Cold Working Processes
V. Heat Treatment
VI Effect of Cold Work on the Physical Properties of Metals
VII. Effect of Cold Work on the Physical Properties of Metals (cont.)
VIII. The Effect of Heat Treatment After Cold Work
IX. Theories of Plastic Flow in Cold Worked Metals
X. The Pathological Aspect of Cold Working Operations
XI. The Application of Cold Work to Non-Ferrous Metals and Alloy Steels

## British Wire Drawing and Wire Working Machinery

**By H. Dunell, A. C. G. I., A. M. I. Mech. E., B. E.**
*(Editorial Staff, "The Engineer")*

**Written from the practical point of view, from the rolling of rods to forming of wire. 186 pages. Cloth bound boards, 7¾x11⅛ inches. Profusely illustrated from photographs. Indexed. Price: $7.00 a copy, carriage prepaid.**

*Contents*

I. The Manufacture of Wire Rods
II. Wire Drawing
III. Dies
IV. Wire Drawing Blocks
V. Continuous Wire Drawing Machines
VI. Straightening and Cutting off Machines
VII. Wire Factories
VIII. Wire Netting Machinery
IX. Wire Factories
X. Wire Weaving Looms
XI. Electric Cable Making
XII. High Speed Stranding Machines
XIII. Barbed Wire Machines
XIV. Nail and Rivet Making Machines
XV. Pin Making Machines
XVI. Needle Making
XVII. Safety Pin Making
XVIII. Wire Chain Making
XIX. Wire Flattening
XX. Miscellaneous Machines

**Both of these books will be sent postpaid to any one address at the special combination price of $18.00. Remittance should accompany all orders. Address:**

**551 Fifth Avenue** **WIRE & WIRE PRODUCTS** **New York City**

# BUYERS' GUIDE, Continued

**MACHINERY—Pin & Needle**
J. I. Bernitz, New York.
M. A. Irmischer, New York.

**MACHINERY—Screw Wire**
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY — Wire Forming Second-hand**
Jesse Atherton, Providence, R. I.

**MACHINERY—Spring Making**
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Staple**
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. A. Irmischer, New York.

**MACHINERY—Straightening**
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. A. Irmischer, New York.
F. B. Shuster Co., New Haven, Conn

**MACHINERY—Stranding**
J. I. Bernitz, New York.
M. A. Irmischer, New York.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

**MACHINERY—Spooling**
American Insulating Machinery Co., Phila.
M. A. Irmischer, New York.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

**MACHINERY—Panning**
American Insulating Machinery Co., Phila.

**MACHINERY—Testing**
Henry L. Scott Co., Providence, R. I.

**MACHINERY—Trolley Wire**
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

**MACHINERY—Winding**
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

**MACHINERY—Wire Drawing**
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
M. A. Irmischer, New York.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
The Torrington Manufacturing Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

**NEUTRALIZING COMPOUNDS**
Oakite Products, Inc., N. Y.

**PATENTS**
Lancaster & Allwine, Washington, D. C.

**REELS—Annealing**
American Pulley Co., Philadelphia, Pa.
Apco-Mossberg Co., Attleboro, Mass.
R. B. Hayward Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**PRESSES—Rivet & Bolt**
M. A. Irmischer, New York.

**SOAPS—Wire Drawing**
R. H. Miller Co., Homer, N. Y.

**SOLDER—Silver**
Handy & Harman, New York.

**SPOOLS—Wire & Cable**
American Pulley Co., Philadelphia, Pa.
Apco-Mossberg Co., Attleboro, Mass.
R. B. Hayward Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

**TRUCKS**
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

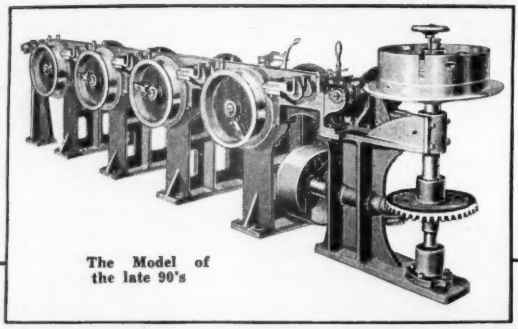
This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.


# WATERBURY-FARREL TANDEMS

*Three Decades Perfecting Continuous Wire Drawing Machines*

We thought the old machines were pretty good in the old days (and they were) but times have changed. Today we offer not a better method nor a new principle, but—a far better machine that meets in eloquent fashion every demand of the present day—

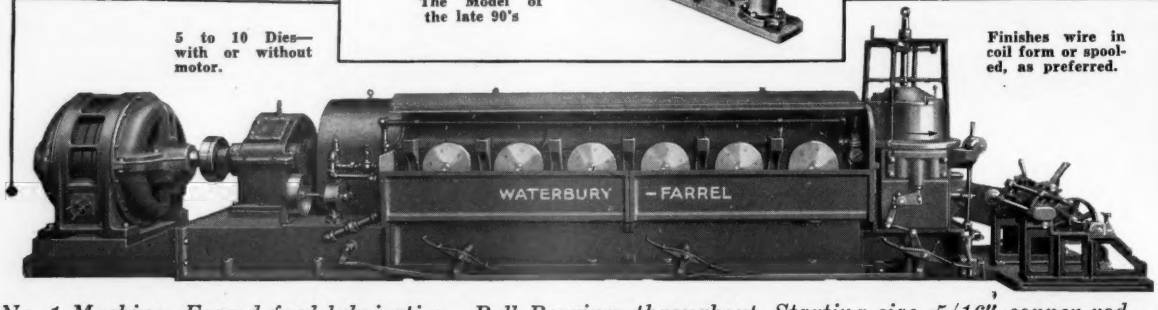
High Speed
Low Operating Cost
Mechanical Efficiency



The Model of the late 90's

5 to 10 Dies—with or without motor.

Finishes wire in coil form or spooled, as preferred.




*No. 1 Machine. Forced feed lubrication. Ball Bearings throughout. Starting size, 5/16" copper rod.*

## The Waterbury Farrel Foundry and Machine Company

**Home Office and Works: Waterbury, Connecticut  Western Sales Office: Cleveland, Ohio**

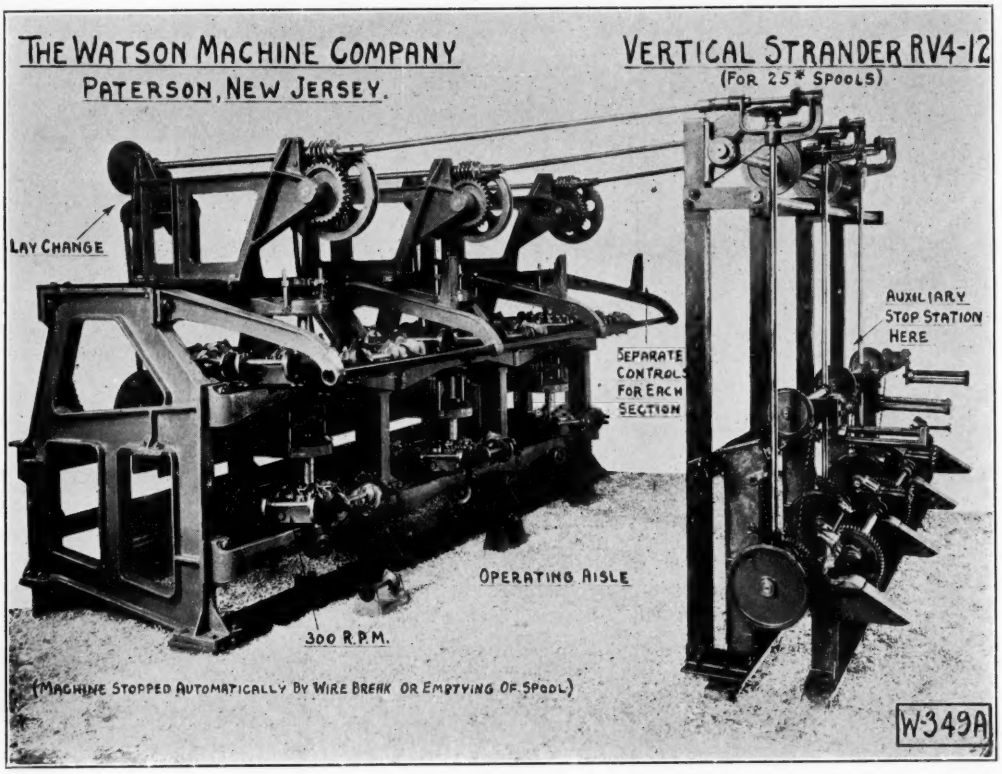
# THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ENGINEERS - FOUNDERS - MACHINISTS

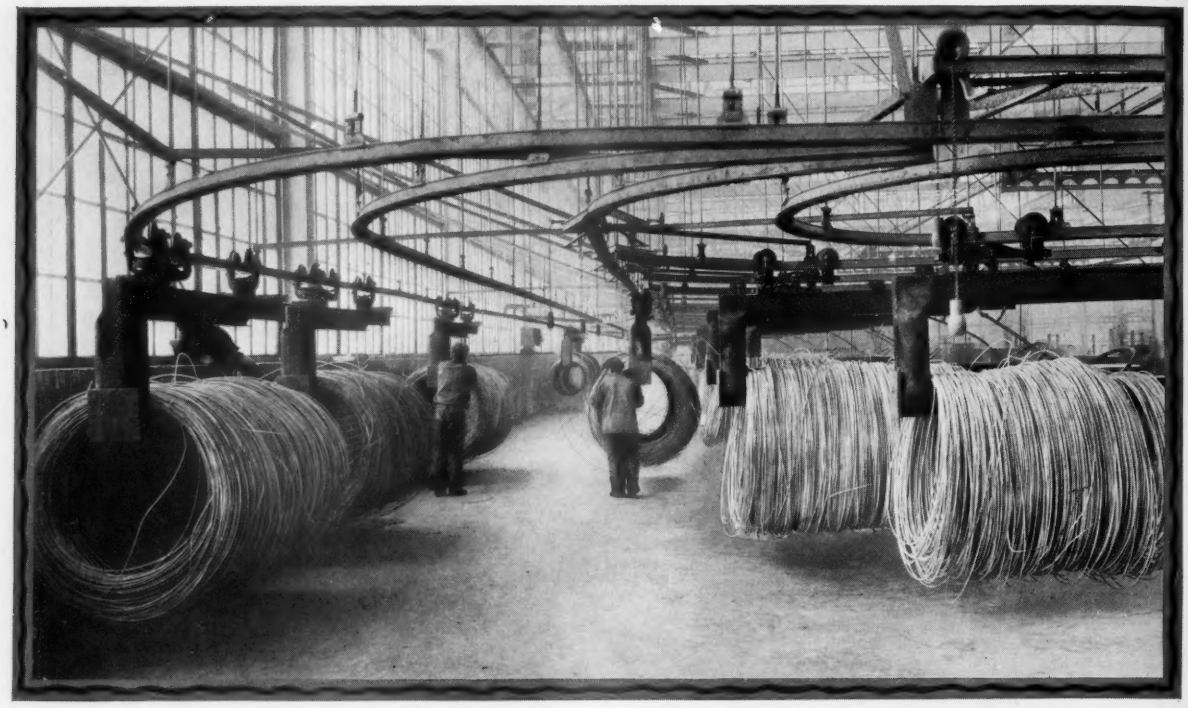
---




**Average production, 9 hour day, on 18 to 50 M. copper 35,000 feet. (Taken from actual record.)**

---

ELECTRICAL WIRE AND CABLE
WIRE ROPE and CORDAGE MACHINERY



We offer our services as Consulting Engineers in wire mill layout and practice. Our experience covers the design of new plants as well as the study of existing plants and the recommending of changes designed to reduce operating costs.

**MORGAN CONSTRUCTION COMPANY**
Worcester, Mass.

# MORGAN
## WORCESTER
*Engineers and Manufacturers*